DOCUMENT RESUME

ED 044 122 LI 002 125

AUTHOR	Fry, Bernard M.; And Others
TITLE	Design Study for Long Range Research Program.
INSTITUTION	Indiana Univ., Bloomington. Research Center for Library and Information Science.
SPONS AGENCY	Department of the Army, Washington, D.C.
PUB DATE	10 Apr 69
NOTE	117p.
EDRS PRICE	EDRS Price MF-$0.50 HC-$5.95
DESCRIPTORS	Government Libraries, *Information Centers, Information Needs, *Information Networks, *Information Services, *Information Systems, Libraries, Program Design, Research Design, Research Methodology, Research Projects

ABSTRACT

A plan is presented for a long-range research program, the objective of which will be to identify technical information problems and policies relating to Federal libraries and information services, to determine priorities among those issues requiring attention, and to develop research designs for each project recommended. The program is presented in the following three phases: (1) a study of the state-of-the-art; (2) the identification of problems requiring research and distinguishing between those which should be in the province of the Department of Defense (DOD) from those which should have multiple sponsorship and those which should be sponsored outside DOD; and (3) an implementation plan consisting of a series of research designs for each project recommended which will state the objectives, the methodology to be employed, the scope of the investigation, the nature of the research, research staff required, the time schedule, and the estimated cost. (MF)

ED044122

U.S. DEPARTMENT OF HEALTH, EDUCATION
& WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

TISA Project Work Unit 01/003

DEC 1 1970

DESIGN STUDY
FOR
LONG RANGE RESEARCH PROGRAM

Bernard M. Fry
Miles A. Libbey
Allan D. Pratt
Thomas J. Waldhart

Research Center for Library and Information Science

Graduate Library School
Indiana University

April 10, 1969

Prepared for
Office of the Chief of Engineers
Department of the Army

LI 002 125

ED044122

ABSTRACT

A plan is presented for a three-phase long-range research program the objective of which will be to identify technical information problems and policies relating to Federal libraries and information services, to determine priorities among those issues requiring attention and to develop research designs for each project recommended. The first phase would consist of a state-of-the-art study to identify all current or recent research germane to the objective. The second would review all aspects of Federal library and information service operations to determine where problem areas might exist. Then specific problems and policies affecting the effectiveness and efficiency of Federal technical information support activities would be identified within such problem areas, priorities assigned to them and a determination made as to the extent of DOD (especially Department of the Army) and other agency interest in them. Finally, in the third phase, a fairly detailed research design would be developed for each project determined to be of some degree of interest to DOD or to sponsoring agencies outside DOD. It is recommended that after the completion of these three phases a continuing study effort at an appropriately reduced level of activity be maintained to assure currency and relevance of the long-range research program. A plan for implementation of the program is included.

FOREWORD

This design study has been conducted as an investigation sponsored by the U.S. Army, Office of the Chief of Engineers, in support of the TISA Project Work Unit 01/003. The purpose of this study has been to design a planned long-range research program to identify technical information problems and policies relating to Federal libraries and information services, and to determine priorities among those issues requiring attention. The work has been performed by the faculty and staff of the Research Center for Library and Information Science, Graduate Library School, Indiana University, Bloomington, Indiana.

Special assistance has been given by Paul Howard, Executive Director of the Federal Library Committee. In addition, the advice and comments from various faculty members at Indiana University have been most helpful. The manuscript has been prepared for submission by Nancy Pierce.

TABLE OF CONTENTS

Abstract i

Foreword ii

Detailed Outline of Body of Report iii

I. Introduction 1

II. First Phase: State-of-the-Art Study 10

III. Second Phase: Problem Identification 29

IV. Third Phase: Development of Research Designs . . 79

V. Continuation Activity 92

VI. Implementation of Long-Range Research Program . . 96

References Cited 104

DETAILED OUTLINE

I. INTRODUCTION 1

A. Purpose 1
B. The Need for Research 4
1. The Field as a Whole 4
2. Technical Information Support Activities 5
a. Administrative 5
b. Technical 6
c. Professional 8

II. STATE-OF-THE-ART SURVEY 10

A. Introduction 10
1. Scope 10
2. Advisory Committee 11
B. Identification of Sources for Project Information 12
1. Federally Funded Projects 13
a. Direct/sponsor method 13
b. Direct/project method 14
c. Indirect method 14
2. Non-Federally Funded Projects 16
C. Development of a Standard Set of Data Elements 17
1. DD Form 1498 17
2. Interview and Questionnaire Versions of DD 1498 19
D. Preliminary Screening of Sources 19
E. Data Gathering From Sponsor Sources 21
F. Data Gathering From Project Sources 22
G. Analysis of Data Gathered 24
1. Purpose of the Output 24
2. Form of Output 24
3. Indexes to Report Collection 25
a. By Subject Treated 25
b. By Sponsor 26
c. By Information Function 26
d. By Special Interest Areas 26
e. By Level of Effort 27
4. Use of Computers 27
5. Continuation of Survey 27
H. Preparation of Final Report of First Phase 28

III. IDENTIFICATION OF PROBLEMS 29

A. Introduction 29
B. Identification of Problem Areas 31
1. Missions and Externally Established Objectives 32
a. Relative to Presently Stated Requirements 34
b. Relative to their Full Potential Under Existing Technology 34
c. Relative to Optimistic Projections 35

POOR ORIGINAL COPY - BEST AVAILABLE AT TIME FILMED

III. IDENTIFICATION OF PROBLEMS (con't)

2. Networks, Coordination, and Cooperation 36
  a. Libraries and Information Centers 37
  b. Army and other Department of Defense 38
  c. Department of Defense and other Federal 39
  d. Federal and All Others 40
3. Objectives Established Internally by Technical Information Support Activities 41
  a. As Indicated by user satisfaction 42
  b. As measured by existing measures 42
  c. As assessed by the impact they are making 43
4. According to the Extent to which Good Management Practices are Followed 43
C. Specific Substantive Areas 45
1. Sciences 47
2. Technologies 48
  a. Computers 49
  b. Telecommunications 50
  c. Microforms 50
  d. Reprography 52
  e. Storage 53
  f. Audio-visual 55
  g. Computer-Assisted Instruction 55
  h. Libraries and information centers as Education Centers 56
3. Functions 57
4. Services 59
  a. Loan 60
  b. Issue 60
  c. Reference and Referral 60
  d. Selective Dissemination of Information (SDI) 61
  e. State-of-the-art reviews 62
  f. Current awareness 62
  g. Retrospective searches 63
  h. Other 64
5. Modes of Response 64
  a. Reference Retrieval 65
  b. Data 65
  c. Full-text 66
  d. Information 67
  e. Dialogue 68
6. Evaluations and Measures of Effectiveness 68
7. Channels of Formal and Informal Communication 69
D. Specification of Problems within Problem Areas 69
1. Literature search 72
2. Opinions and recommendations 73
  a. Study project staff 74
  b. Army 74
  c. Other Department of Defense 74
  d. Federal (including FLC, COSATI, etc.) 75
  e. All others 75
3. Restatement of Problems in Terms of Specific Problem Areas 75

III. IDENTIFICATION OF PROBLEMS (con't)

- E. Restatement of Research Identified in First Phase in Terms of Specific Problem Areas 75
- F. Select Problems Requiring Research and Distinguish Responsibility 76

IV. DEVELOPMENT OF RESEARCH DESIGNS 79

- A. Introduction 79
- B. Gather Feedback From Second Phase Report 80
  - 1. Dissemination 80
  - 2. Collection 81
    - a. Working Conference 81
    - b. Alternatives 83
- C. Evaluation of Feedback and Modification of Second Phase Recommendations 84
- D. Development of Individual Research Designs 85
  - 1. Independent Variables Associated with the Research Designs 85
  - 2. First Round Development of the Research Designs 85
    - a. Statement of Problem 86
    - b. Objectives 87
    - c. The Methodology to be Employed 87
    - d. The Scope of the Investigation 87
    - e. The Nature of the Research Project 88
    - f. Research Staff Required 88
    - g. Time Schedule 88
    - h. The Estimated Cost 89
- E. Determination of Budgetary and Other Constraints 89
- F. Normalize and Re-distribute Emphasis as Necessary 90
- G. Modification of Research Designs 91

V. CONTINUATION ACTIVITY 92

- A. Introducation 92
- B. Maintenance of a Directory of Research in Progress 92
- C. Continuation of Problem Identification Effort 93
- D. Continuation of Research Design Development Effort 93
- E. Revision of the Long-Range Research Program Itself 93
- F. Reporting the Continuation Activity 94
- G. Statistical Reporting 94

VI. IMPLEMENTATION 96

- A. Time Estimate 96
- B. Cost Estimates 98
- C. Sponsorship and Size of Project 98
  - 1. Reduced Resources 99
  - 2. Increased Resources 99
  - 3. Specific Recommendations 100
- D. Single Versus Multiple-Contractor Implementation 101

REFERENCES CITED 104

I. INTRODUCTION

A. Purpose

The purpose of this report is to present a plan for a long range research program the objective of which will be to identify technical information problems and policies relating to Federal Libraries and information services, to determine priorities among those issues requiring attention and to develop research designs for each project recommended. The program here presented is subdivided into three phases according to the guidelines provided by the contracting authority, the Office, Chief of Engineers, of the U.S. Army:

> "a. The first study will be a state-of-the-art study which will identify all current Federal Library research and evaluate it as to its objectives.
>
> b. The second phase will include identification of the problem areas requiring research and distinguishing between those which should be the peculiar province of DOD from those which should have multiple sponsorship and those which should be sponsored outside DOD.
>
> c. The third phase will consist of a series of research designs for each project recommended which will state the objectives, the methodology to be employed, the scope of the investigation, the nature of the research, research staff required, the time schedule, and the estimated cost."

The effort which resulted in this report, which hereafter will be referred to as the "design study," was initiated by the Technical Information Support Activities Program*(TISAP), in cooperation with the Federal Library Committee.

The assumption has been that it would be wasteful for TISAP to make such a study without including other DOD agencies and indeed the total Federal environment. The anticipated end result would be a structured, on-going research program which would concentrate on the technical information problems of the Army, but also consider them in relation to the needs of information programs in general and of Federal technical information programs in particular.

---

*The Technical Information Support Activities Program is the successor of, and enlargement of, the Army Technical Libraries Improvement Studies (ATLIS). The principal enlargement consists of the inclusion of "information analysis centers" and "information centers" in the same overall program as technical (often referred to as "special") libraries.

Inevitably, then, the design study had to be conducted as if it were being done on behalf of the entire Federal community, yet without losing sight of the fact that it had its origins within a single element of that community, and that, so far, its financial sponsorship and technical direction must be credited entirely to that same element, the U. S. Army Research Office, through the Office, Chief of Engineers of the U. S. Army. This fact, together with the dismayingly broad substantive coverage, the possibly very great impact of the program which could result from its recommendations and the fact that the heart of that program lay in a largely uncharted area, that of problem-identification, as contrasted with the better understood area of problem-solving, had two immediate consequences for the design study which may be considered to be related to its purpose. In the first place it produced a great humility. In the second place it demanded that the persons involved keep strictly in mind their position of being serveral levels removed from the operational scene towards which everything was eventually pointed. Not only were they not dealing with primary operations, they were not dealing with secondary (or supporting) operations, such as technical information support operations, or with the research on which new operations would be designed or even directly with the selection and specification of that research. Their real purpose, which had to be kept in focus at all times, was to develop--or at least outline a means for developing--the methodology for an on-going, planned research program on Federal library and information service operations. Figure 1. depicts the relations between the different activities more clearly.

LEVELS REMOTE FROM OPERATIONS	ACTIVITY	PURPOSE	
		PRESENT	FUTURE
4	Present Design Study	To design the Long-Range Research Program	
3	Long-Range Research Program	To design the Research Program on Federal library and information service operations systematically and objectively	To keep track of progress toward solving technical information problems and policies and to recommend revisions to the Research Program on Federal library and informations service operations
2	Research Program on Federal Library and Information Service Operations	To improve the effectiveness and efficiency of Federal library and information service operations in providing technical information support to designated "users"	Continue Present Purpose
1	Federal Library and Information Service Operations	Provide technical information support to designated "users"	Continue Present Purpose
0	Federal Management, Operations and Research	To perform statutory functions and missions and tasks to support them	Continue Present Purpose

FIGURE 1.

B. The Need for Research

To discuss in general terms the needs for research in Federal Libraries and information services for the readership of this report would indeed be carrying coals to Newcastle. Yet, not to address the need question at all would be like designing a system without stating its objectives. (The term "objectives" in this sense refers to meeting of requirements and needs rather than to the task descriptions on which the three phases are based.) This report outlines a system of proposed actions which, like any other system, will use resources, in environments, to attain objectives. These objectives simply cannot be stated in such clear terms as "Build a bridge," "Synthesize an enzyme," "Develop an alloy." Nevertheless they determined the attitudes of the personnel participating in this design study toward the needs for research in the field, hence toward the problem identification process. Some awareness of that attitude is a vital part of the communication process undertaken by this report. The need for research in the field as a whole and the need for the particular kind of research that would relate to technical information support activities are both important and must be discussed separately.

1. The Field as a Whole

Thanks to the recency, hence continuing validity, of the thorough, painstaking and prestigious report of the National Advisory Commission on Libraries, transmitted to the President on October 3, 1968, the condition of the overall field of library and information science and the need for a stepped up and coordinated program of research therein can be treated with dispatch. After reviewing a number of areas in which the application of new technology offers particular promise, the commission said: --

> "The realization of all that is implied in this array of new technology can be achieved only by a substantial program of research and development. This Commission urges that the Federal Government should actively promote research and development in all aspects of technology as it relates to libraries and information transfer. To this end the proposed National Commission on Libraries and Information Science should develop an integrated plan of support and cooperation involving the various Federal agencies now sponsoring such research and development work. Such a plan would greatly aid the continuation and strengthening of the current grant and contract program, which involves research and development projects at universities, private and public libraries, nonprofit research and development organizations, professional societies, and private companies."

In its recommendation for the "establishment of a Federal Institute of Library and Information Science as a principal center for basic and applied research in all relevant areas", the Commission left no doubt as to its convictions of the need for such a research program.

2. Technical Information Support Activities

The library and information facilities and services needed to provide "technical information support" will be quite different from those needed to support other information requirements. They will differ in various ways: in the kinds of operations involved, in priorities, in human values, in national urgency and many more. These differences will necessarily be reflected in the problems that relate to efforts to provide technical information support. There are three related points of view from which such problems, and the need to develop a program to identify them, should be considered: administrative, technical and professional.

a. Administrative

The problems just referred to will generally be quite different from the set of problems that relate to, say, the provision of library facilities and services to the urban disadvantaged. The latter, of course, are important. In fact some people, using the criterion of social value proposed by the National Advisory Commission on Libraries, might well decide that they are more important than the provision of technical information support to Federal agencies. No such judgment on the part of a National Commission on Libraries and Information Science would be needed, however, to make that Commission decide to concentrate on such an area as the urban disadvantaged at the expense of technical information support. This is simply because the mission, responsibilities, etc., of the Army, other DOD departments and Federal agencies leave them no choice but to provide for themselves whatever technical information support they need. Thus, if such a permanent Commission as was recommended is established, it cannot be expected to have much direct impact on the technical information support area. It follows that the Army, and other Federal agencies must assume full responsibility for developing their own "integrated plan of support and cooperation involving the various Federal agencies now sponsoring such research and development work."

The long-range research program designed by this study will constitute such a plan for the Department of the Army. It will also constitute an information input to the Federal Library Committee which that Committee indicated it desired. It can constitute such a plan--or useful input to such a plan--for other DOD departments and Federal agencies depending on the resources or other cooperation such agencies may choose to contribute.

b.. Technical

It is especially important when dealing with the technical area to maintain the distinction between the needs for research itself and the need for a systematic approach to the identification of such needs. That there are in fact many needs for research related to technical information support is evident from the extensive discussion of problem areas in III.B. At this point the need for a systematic approach must be considered.

Perhaps the most telling point to be made is that, to date, technical information support capabilities have developed like Topsy; they just grew. And the same is true of whatever scientific or technological advances can be related to the development of technical information support capabilities. These advances have come from piecemeal attacks on narrow problem areas as these have become visible. The process has been one of looking at trees, practically never considering the forest. It has, notwithstanding, produced many advances. Computer-prepared indexes such as KWIC indexes, other current awareness tools, microfiche, "selective dissemination of information" (SDI), retrospective searches by computer, and many more have evolved in that manner.

Despite the advances, the scientists and engineers for whom technical information support activities are maintained make shockingly little direct use of libraries and information services. This was early noted by Vannevar Bush in Science, The Endless Frontier[8] and has since been studies by, among others, the Auerbach Corporation[20] and North American Aviation.[6] Allen et al have considered this and related matters in a series of studies summarized in Reference 17. One conclusion was that

> "the use of technical literature is not outstanding in its contribution to performance. The average engineer makes very little use of publicly available literature forms, especially the publications of the professional engineering and scientific societies."

in a survey of theoretical high energy physicists[16] Libbey and Zaltman found that only one percent (1%) of nearly a thousand responses to a detailed questionnaire listed librarians and technical information personnel as being the most important way of learning of the existence of relevant information!

With so much technical information available and so much more being increasingly produced, such a state of affairs is a serious weak point in our national research effort and in our efforts to exploit technology on the citizen's behalf. Some part of the situation is undoubtedly due to individual, profession and natural factors that no amount of betterment of technical support activities will change. But certainly a large part of the situation is due to a combination of our ignorance of just what the "client" needs with our inability to provide it for him. Many conscientious efforts over recent years to attack these twin wants on one specific basis or another, outstanding among which have been the ATLIS studies, have produced little visible improvement. About the one obvious thing left to try is to attempt to introspectively turn the power of the systematic approach to the task of identifying problems as well as solving them. There is good reason to hope that a serious systematic program oriented to seeking the most crucial questions to ask--without the psychological hazard of responsibility for answering them--will produce a very much better foundation on which to organize a concerted research effort than any other way yet tried or proposed. To design that program is, again, the aim of this report.

c. Professional

One final area which provides an impetus for the establishment of as objective a program as possible for the identification of problems needing research is that of the professions. Professionally, as well as technically, the field--or should it be fields?--of library and information science are, to put it mildly, in a state of flux. There is general confusion as to what belongs in library science and what belongs in information science, if, indeed, they are separate. Worse, there are reservations by many as to whether either is a "science" at all. The profession-confusion extends to neighboring fields. Computers process information so isn't a computer scientist (if, again, there is any such thing) also an information scientist? Similarly for some psychologists and others.

What does this all have to do with the programs here discussed? Simply that in the absence of such a plan as the one designed by this report the identification of problems needing research will continue to be done haphazardly with strong biases toward the existing personal frames of reference as learned in the context of some, usually established, profession.

The study project designed by this report should be inter-disciplinary--and, for those who believe there is a difference, multi-disciplinary. It should be staffed as such; it must be conducted and advised as such. Consequently a teamwork approach should develop in which professional boundaries as well as personal biases should be easily transcended. The beneficial effects in terms of the quality of the final product should be quite important.

II. FIRST PHASE: STATE-OF-THE-ART SURVEY

A. Introduction 10
  1. Scope 10
  2. Advisory Committee 11

B. Identification of Sources for Project Information 12
  1. Federally Funded Projects 13
  2. Non-Federally Funded Projects 16

C. Development of a Standard Set of Data Elements 17
  1. DD Form 1498 17
  2. Interview and Questionnaire Versions of DD 1498 19

D. Preliminary Screening of Sources 19

E. Data Gathering From Sponsor Sources 21

F. Data Gatherine From Project Sources 22

G. Analysis of Data Gathered 24
  1. Purpose of the Output 24
  2. Form of Output 24
  3. Indexes to Report Collection 25
  4. Use of Computers 27
  5. Continuation of Survey 27

H. Preparation of Final Report of First Phase 28

II. FIRST PHASE: STATE-OF-THE-ART SURVEY

A. Introduction

1. Scope

The objective of this first phase of the study is to prepare a "state-of-the-art study which will identify all current Federal library research and evaluate it as to its objectives." It is clear from the wording of other parts of the authorizing document that this survey is intended to include information centers and information analysis centers as well as libraries within its purview. To conduct a state-of-the-art survey of any field it is necessary to bound the field in fairly clear-cut terms, both to provide a focus for locating the information and to prevent the inclusion of extraneous matter. The following is the scope proposed for this survey:

> To identify and describe all current research on Federal library and information service operations which may be:
>
> 1. Funded wholly or in part by the Federal Government which has implications for Federal libraries and information centers.
>
>   or
>
> 2. Investigating some aspect of problems or policies relating to Federal libraries or information service operations irrespective of source of funding.

"Federal libraries and information centers" in this context, and throughout this report, is intended to include both those activities operated directly by the Federal Government and those operated under contract to the government by non-profit or profit-making concerns.

These two provisions circumscribe the area of most interest to the Department of the Army, and DOD generally. With respect to the first point above, it is clear that much research is of interest. The programs at NLM, AEC and other civilian agencies may have much impact on Army and DOD efforts, but, for example, the USOE-supported research with respect to media centers in the secondary schools does not seem relevant. Any attempt to include within the purview of this survey all Federally funded research on library and information services projects will dilute the effort without commensurate gain. Regarding the second point, it cannot be assumed that only Federally funded projects may have a bearing on the question. It is entirely possible, for example, that someone is investigating the technical processing procedures, or the utilization of microfiche, within Federal libraries without necessarily being supported by Federal funds. Thus the survey cannot be limited only to Federally supported efforts. It is probable, however, that the major proportion of projects of interest are indeed Federally supported.

2. Advisory Committee

To provide the best possible guidance for the project, it is recommended that an Advisory Committee be established. This Committee should consist of from five to nine members, preferably representatives of the major research-supporting agencies, such as NSF, DOD and USOE, and of repreeentatives of some of the major research-conducting agencies, such as NLM, AEC, Redstone Arsenal, and the like. The function of this committee would be to advise the study project members with respect to such matters as the selection of agencies to be contacted, the design of any research tools used, and the feasibility of various methodologies. The expertise, both technical and governmental, of such a committee should contribute heavily toward the success of the entire project. Some of the instances in which the Committee would be of great assistance will be noted in the appropriate paragraphs below, both in this section and subsequent ones.

The substance of this design for a state-of-the-art survey is divided into the following sections.

Identification of sources by which projects can be located
Development of a standard set of data elements
Preliminary screening of sources
Data gathering from sponsor sources
Analysis of data gathered
Preparation of final report

B. Identification of Sources for Project Information

The question at hand is, how can projects of interest to this survey be identified? It is perhaps obvious that a number of methods are possible, and perhaps equally obvious that no one method will prove sufficient in itself. Three broad strategies seem possible. They can be characterized as "direct/sponsor", "direct/project" and "indirect". In the direct/sponsor approach, the survey team will contact agencies known to be funding research in this area, and request access to their files, so that specific projects can be identified. In many cases the sponsor can provide sufficient information from its own records to preclude the need for the survey team to contact the project members directly. In the direct/project approach, the survey team will contact agencies known to be undertaking research, and request that they supply them with the necessary data. In the indirect method, the survey team will make use of secondary sources, such as the Defense Documentation Center, National Referral Center, Science Information Exchange, and the published literature, to identify either sponsors or projects, then adopt the appropriate direct method of gathering the needed data.

Quite apart from the strategies noted above, there are two different categories of projects, identified by what ever method. These are, as given in the "scope" statement, those with, and those without, Federal funding. The 2x3 table below suggest the relative importance of each of the three strategies for the two classes of projects.

	Fed.Fund.	Not Fed.Fund.
Direct/Sponsor	P	S
Direct/Project	S	S
Indirect	M	P

P: Primary means of identifying project
S: Secondary " " " "
M: Minor " " " "

1. Federally Funded Projects

a. Direct/sponsor method

The identification of these projects alone is not a trivial matter. The scope and diversity of research in this area which is sponsored by the government, and the lack of any rigorous existing data base make the identification of these projects a matter of some difficulty. As suggested above, it would seem that the direct/sponsor method is the most immediately fruitful. The project team can begin by contacting the agencies within the Federal Government known to support this kind of research. Most, if not all, these agencies maintain rosters or directories of supported projects. Information provided by these rosters is an excellent first step. The Department of Defense, NASA, AEC, and the Department of Commerce, among others, now require that research and development projects be reported on DD Form 1498 (or its equivalent; e.g. NASA Form 1122) to the appropriate office. Some library research projects have likely been reported to this system. DDC, and perhaps other agencies, keep this information in machine readable form, suitable for searching automatically on keywords. The first step in this approach is thus to conduct a "literature search" of these project files already maintained in one form or another by these agencies. The list of agencies to be contacted for this searching will be established, extended and modified based on guidance from the

Advisory Committee. In addition, the Committee will often be able to furnish valuable information regarding the specific branch, or individual, to be contacted for this information.

It should be noted that one or more survey team members may be required to have security classifications of SECRET. It is not likely that there are many classified projects in this area but there may be some which require use of classified files. Advice of the Committee will again prove helpful here. The project should aim at coverage of projects dealing with "information handling" of classified topics, but should not become involved with intelligence or counter-intelligence related projects (i.e. the survey should not attempt to determine what, if any, relevant research is being conducted by the CIA, DIA, NSA, and similar agencies).

b. Direct/project method

The direct/project method of gathering information on this type of research involves the distribution of a questionnaire to installations inquiring as to the nature of their projects, if any, augmented as necessary by visits, telephone calls, and correspondence. This might seem to be an obvious first-choice method. There are two drawbacks however. First, it will require that the reporting installations, in many cases, give the same data already available elsewhere. Second, many, if not all, will be extremely reluctant to reveal this data to "outsiders," particularly funding and manpower levels. In some cases, as is noted below, this will be the only available way to gather data however, and thus will be appropriate. In the main, the direct/project approach should be supplemental, not primary.

c. Indirect method

The indirect method requires the searching of the published literature, (in either periodical or report form) and, of course, the appropriate abstracting and indexing journals (USGRDR, Information Science Abstracts, etc.). In addition the services of such agencies as the Science Information Exchange, the National Referral Center and the Clearinghouse for Library and Information Science (ERIC/CLIS) should be used. In addition to discovering the existence of some previously unknown projects, the indirect method may lead back to some contract-awarding source within the government which was initially overlooked. The survey team would in this case adopt the direct/sponsor method to determine if that sponsor had awarded any similar contracts. In addition, there is a possibility of discovering some Federally funded projects not locatable by either of the other two methods. The Federal Government has made block grants for library and information science activities to, e.g. State Libraries, often in the form of matching funds. Some of these funds have been awarded by those State Libraries for local development tasks such as the Purdue University Serials Project. In other cases, however, these funds may be supporting research projects. This research may be relevant to the problems of Federal libraries, but even if so, it will be locatable only through the indirect method, since there is no requirement that such research be reported to any clearinghouse.

As mentioned above, the direct/project approach has its disadvantages but particularly in the case of projects unearthed via the indirect method, contacting the research group in question will be the most feasible approach. One way to implement this direct/project approach and yet avoid excessive duplication would be to use the already existing directories of Federal libraries[32] and information centers[30] as starting points, but omitting those installations already identified by means of the direct/sponsor approach. With this method, most of the installations which are conducting research under an inter-agency agreement or from their own funds can be identified. Many of these projects are likely to be overlooked by the direct/sponsor strategy because they are not necessarily reported through the usual channels. The indirect method is also likely to overlook projects of this nature, because the compulsion to publish results of research is not so great in this environment as in the non-profit or profit-making institutions which normally accept contracts. It is impossible to estimate how much research of interest to this study is being undertaken by such Federal installations, but some experience in other areas suggests that it would be wise not to overlook this possibility.

Two instances may illustrate this, though they are more properly development than research. A small group of programmers developed a method of converting IBM 1401 programs to S/360 programs automatically, a project IBM felt was sufficiently unlikely to be successful that it decided not to expend any serious effort on it. In another instance, an "amateur" programmer developed an on-line library circulation control system by time-sharing a 1401, something that no "expert" thought was feasible.

2. Non-Federally Funded Projects

The same three strategies as outlined above for Federally-funded projects are applicable to non-Federally funded projects, but with a different emphasis. The indirect method of locating projects will probably be more important, because there is no single small group of non-Federal sponsors from which most of the necessary records can be obtained. Thus the study group will be heavily dependent on secondary sources. Among the obvious sources are the Science Information Exchange in Washington, because it accepts and processes information from non-Federal as well as Federal projects, and the ERIC/CLIS in Minneapolis, because it likewise has a broad charter. In addition the usual bibliographic sources must be checked (Library Literature, Information Science Abstracts, etc.).

In addition, there are, of course, some notable sponsors of this kind of research, such as the Council on Library Research and the Ford Foundation. The study group can use the direct/sponsor approach here, to identify projects, following up as necessary. Finally, the direct/project strategy, using a questionnaire, can be adopted, contacting a variety of possibly relevant institutions which have not been otherwise identified. However, the political dynamics of research and its reporting in the academic and other library environments suggest that the survey group is not likely to disciver many unreported projects, in contrast to the sitatuion in Federal installations. It does not seem worth the effort to query "shot-gun" style the large number of libraries and other institutions which might conceivably be engaged in relevant research. The potential return does not seem worth the cost, especially since any research having real importance to the project aims will probably be reported in one of the secondary sources shortly after completion.

C. Development of a Standard Set of Data Elements

1. DD Form 1498

The determination of the nature of the data to be gathered is clearly a function of the results desired. A reasonable starting point would be the DD Form 1498 and its equivalents in NASA, AEC and other agencies. This form has the advantage of already being required in many cases; thus the data gathering effort previously expended would be used directly. In many instances, keywords are assigned to the project descriptions, a further benefit to the study team. As a starting point then, the project should consider the use of DD Form 1498 as a base, augmenting it as necessary. This will considerably simplify the data gathering in the direct/sponsor strategy. The same form will serve as as worksheet to be completed (insofar as is possible) when projects are identified via the indirect method, and also serve as the basis for the development of a questionnarie for the direct/project strategy.

It is probable that most of the projects will be Federally funded; thus it seems worthwhile to use the same format for the smaller number of non-Federal projects. Clearly, the same format should be used for all projects, regardless of fund source, particularly if the data is to be converted to some machine readable form, as is anticipated.

DD 1498 cannot be used without considerable thought on the part of the survey team, however. The COSATI specifications give some elucidation of the meaning of the various data elements, but some elements must be clarified or modified by the project. In particular, the item dealing with category or class of project must be modified. The classification assigned by the preparing agency fits the project into a large, multi-purpose scheme suitable for DOD needs. If the survey team decides to use a classification scheme adapted to library and information science in general, such as the _Information Science Abstracts_ scheme suggested below, that classification code should be used instead of the DOD code. Some additional data elements may also be required. For example, DD 1498 does not provide for entry of the "subject matter" of the data base being experimented on by a project, an item likely to be of great interest to the survey team. Further, the study team may wish to categorize projects with respect to their relation with other projects, the possible long-range benefits, and the like. Therefore, the study team may wish to add other items to DD 1498, items to be recorded by the team itself rather than by the leaders of the projects.

2. Interview and Questionnaire Versions of DD 1498

Using the modified DD1498 as a base, the study team should recast it into two further forms. Firstly, it should be rewritten in the form of an interview guide, for either face-to-face or telephone interviews. Secondly, it should be rewritten as a questionnaire intended for mailing. These forms will be especially valuable when identifying non-Federal projects. Bureau of the Budget approval will be required for any such forms. The Advisory Committee will again be helpful with respect to this matter. Their assistance in the augmenting and revision of DD 1498 will help insure that the study team does indeed cover the appropriate areas.

D. Preliminary Screening of Sources

As was noted in Section B., the direct/sponsor method seems to promise the most immediate results in terms of identifying projects of interest. Therefore, one of the early tasks of the study group will be to develop as comprehensive a list as possible of actual and probable Federal funding agencies. This list should be as specific as possible; e.g. it should give the name and address of the office(s) within a given agency which has the actual responsibility for project monitoring. Some of these sources are well-known, (NSF, AFOSR, etc.) others may be less conspicuous. The Advisory Committee will no doubt make one of its most valuable contributions in assisting with the preparation of this list.

As a second step, which will both check the preparation of the list of sources and reveal projects directly, a search of the various agency files (DDC, NASA, AEC) for current projects relating to libraries and information services should be made. In principle, all these projects should fall under the jurisdiction of the one or the other of the contracting offices already identified, but some may not. Such not-yet-identified projects could be candidates for the direct/project method.

These two steps should provide the survey team with a reasonably complete and comprehensive starting point for the actual data gathering from sponsors with respect to Federally funded projects. A similar set of steps with respect to non-Federal sources should be taken. The study team, in conjunction with the Advisory Committee, should develop a list of sponsoring sources outside the Federal Government, and augment it by recourse to the National Referral Center, ERIC/CLIS, and similar groups. Volume 15 of Current Research in Scientific Documentation, soon to be published, will be a valuable source for identifying such sponsors.

In the course of its work in gathering together a list of research sponsors, the study team will inevitably identify a number of research projects, since this can hardly be avoided. There is no point in passing over material which will be of interest in a later stage, so the study team will in fact begin its compilation of projects concurrently with the identification of sponsors of projects. At this stage there is no need for completeness, nor for contact with identified research projects. They should simply be noted and as much information as is readily available recorded at the time. The contract number would be a particularly useful data element to record at this time since it will be an important key in determining whether a given project has or has not been previously identified. In general the same philosophy can be applied to the identification of problem areas and of specific problems in anticipation of the second phase of the study project.

Thus, at the completion of this effort, the study team will be in possession of a reasonably complete list of sponsors, both Federal and non-Federal, of the kinds of research relevant to this survey. With this list, the team can begin the actual data gathering, first from sponsors, as described in Section E, then from projects directly, as described in Section F.

E. Data Gathering From Sponsor Sources

The survey team should contact all of the sponsoring agencies on the list developed in Section D. above, to gather information on specific projects handled by those agencies. It is worth noting here a point which may arise in connection with data gathering from both sponsors and research groups. There may be a reluctance on the part of either or both sponsors and researchers to reveal certain data. Funding and manpower levels are likely to be quite sensitive matters. Further, some sponsors/researchers may be reluctant to describe their projects in any reasonable detail, for a variety of reasons. If such instances arise, the study team must defer to these attitudes, even though it might in some cases be possible to exert enough "pressure" to get the data released. Pressure of this kind would no doubt do more harm than good.

Assuming that difficulties of this kind are minimal, however, the study group should be able to gather a fairly comprehensive view of Federally supported projects. In some instances, (e.g. DDC) it should be possible to conduct this search automatically by searching tape files of the DD 1498's. Similar such searches may be possible at NASA and AEC. Some of the other agencies' files may not be searchable by other than manual means. However searched, the results should be essentially the same; in essence a completed DD 1498, augmented as the study team and Advisory Committee feel necessary for each project. The study team should compare the data thus gathered with the partial list of projects previously developed (cf. Section I.D. above) as a check on the accuracy of the sponsor's files. If a large number of projects are missing from project files, the study team will be forced to use the direct/project (questionnaire) method more extensively than was first thought. In some instances the DD 1498's (or equivalents) may be ambiguous and/or incomplete. Follow-up action by contacting the project personnel or the sponsor will be necessary in these cases.

The data gathered in this phase of the operation should be converted to machine-readable form, since not only will much manipulation be required to produce the final report, but much interrogation and cross-checking will be necessary in the course of correlating it with data derived from other sources.

F. Data Gathering From Project Sources

In the case of projects which have not been identified or adequately reported by the direct/sponsor strategy it will be necessary to obtain information from those directly involved in the projects. These projects can be expected to be mainly those undertaken by Federal agencies (usually, but not necessarily, field installations) from their own funds and personnel. One approach to identifying these is to use as a guide the listings of Federal Libraries and Information Centers previously noted (References 30, 32) but omitting those already identified via the direct/sponsor method. The two references list some 500-600 facilities. Some portion of these will already known to be undertaking projects, and thus already identified. The resulting list can be winnowed further, with the assistance of the Advisory Committee, by eliminating those facilities known by the committee members not to be engaged in relevant work. The remaining facilities should be asked to either complete the questionnaire version of DD 1498, or to indicate that they have no projects of interest.

The indirect (secondary sources) strategy will, of course, influence both the methods outlined above. The study team should carry on a continuing review of the various announcement, indexing, abstracting, and review media to identify either sponsors or projects of interest, adopting one strategy or the other as circumstances warrant. Among the more important such media are USGRDR, Information Science Abstracts, ERIC/CLIS, SIE, any successor to Science Information Notes, the National Referral Center, etc. Additional such sources are the announcements of grant awards by USOE, NSF, CLR and others. Also CRDSD No. 15 and the then current volume of the Annual Review of Information Science and Technology series should be carefully covered.

The indirect method of locating projects through secondary sources will probably produce its highest yield in terms of non-Federal funded projects, particularly those which are conducted by institutions or contractors from their own resources rather than from grant funds. Whether many of these are important to the Department of the Army or DOD must remain to be seen.

The execution of this step may result in acquiring many more project descriptions, in addition to those already obtained through previous efforts. The survey team must take particular care to keep this input under good control. Otherwise they are liable to become inundated in a flood of unmanageable data. In particular, as the file increases, the chances of identifying some projects more than once, and of missing other, increases.

Some additional remarks on data management are included in the following section.

G. Analysis of Data Gathered

Since this state-of-the-art survey is to form a substantial part of the foundation on which subsequent phases are to be based, some discussion of the analysis of the resulting data is in order. Specifically the two questions, "What is the purpose of the output?" and "What form best suits that purpose?" should be addressed.

1. Purpose of the Output

The purpose of the state-of-the-art survey is to provide a basic overview of the current picture of research in Federal Libraries and information services, for use in the second and third phases of the study project. A simple chronological, alphabetical, or other listing would not suffice. As is described in Section III of this study, there are a wide range of possible points of view from which these research problems can be described and characterized. Thus, it would be appropriate to create the output of this phase in a flexible form, so that it is adaptable to as yet unforeseen requirements. This survey data will form the "raw material" from which several different interpretations can be drawn, and thus should be amenable to being re-organized as needed.

2. Form of Output

The purpose described above suggests that a single form of output would not be adequate for the needs of the later phases. Two basic approaches to output would appear to be required. The first of these, a "conventional" one, results in the publication of a group of reports. One reasonable form in which these could appear would resemble that of a single issue of an abstracting and indexing bulletin, similar to an issue of U.S. Government Research and Development Reports, for example. Each project identified in the course of the survey would be entered separately, in effect, as a copy of the modified DD 1498. This would provide for each project a short, concise overview of its essentials. The entire collection of such project reports could be arranged in a variety of ways.

Perhaps the most useful arrangement would be in a classified order, arranging the summary entries according to the classification scheme used in, e.g. Information Science Abstracts. This classification provides ten major categories, with from four to seven subdivisions under each, which should provide sufficient resolution for this study. Such an arrangement will bring together all reports of projects dealing with, say, SDI systems, regardless of the subject matter of the information being selectively disseminated.

3. Indexes to Report Collection

In order to provide access from the variety of viewpoints required, it will be necessary to provide a number of indexes to the basic collection of reports.

a. By Subject Treated

One of the most obvious such indexes is by subject treated; that is, the subject matter of the material being handled or experimented upon. In general the feeling seems to be that most information storage and retrieval (ISR) techniques are insensitive to the subject matter of the literature, except for such things as chemical structure searching and similar very specialized tasks. However, it may prove useful to discover, for example, that a large fraction of the DOD effort is devoted to the processing of electronics and instrumentation or metallurgical literature, but little human engineering or logistics literature.

b. By Sponsor

Another useful index to the report collection is by administrative or corporate sponsor. Such an index would permit the identification of all those projects under the sponsorship of a particular agency, thus providing a view of the diversity of support among various agencies.

c. By Information Function

Another possible index would organize the reported research in terms of the library or information service function being studied. That is, projects would be classified as to whether they dealt with matters of acquisitions, technical processing, circulation, personnel, users, etc. This analysis, while somewhat similar to the general classification noted above, would focus attention directly on projects in terms of their possible impact in an operational environment.

d. By Special Interest Areas

A further framework within which one could view the identified projects would be that of recommendations of particular study groups, such as suggested in the Proceedings of the Forum of Federally Supported Information Analysis Centers.[26] Appendix A of that report lists some 43 "Problems Requiring Attention", along with 15 "Recommendations to COSATI". This list of problems certainly suggests that research projects in these areas might prove useful. However, the nature of the problems as stated are rather more vague than one would like. For example, Problem 21: "How to find trained people;" Problem 21 "How to locate and obtain unpublished data;" Problem 34: "How to handle publicity", all seem difficult to conceptualize as research projects. Some of these problems are, however, more amenable to research; e.g. Problem 26: "How to identify the users, determine what they think they need and what they actually need."

e. By Level of Effort

Another useful viewpoint would be in terms of funding and manpower levels devoted to each project. This data could be correlated with any one or more of the previous aspects, so that one could determine, for example, how much effort the Department of the Army is expending in research on classification, or how much the Department of the Navy is expending on research in SDI Systems. Such an analysis would bring out the variations in support both by agency and by type of effort.

4. Use of Computers

It would be possible to list a variety of other ways in which the information could be listed, but it is difficult to determine which of these ways would be worthwhile at this time. Because of this fact, and because of the unpredictability of the further progress in this field, a second form of output is strongly suggested. This second form is, of course, computer-readable form.

Placing all the survey data in machine readable form has two major advantages. In the first place, even if only a published version were prepared, the extensive indexing and cross-correlations required, as well as the extensive editorial work associated with the basic data itself would probably warrant some sort of computer-assisted publishing method. Even more important, however, is the strong possibility suggested above, that after the total project moves into the second and third phases, new considerations will arise which were not allowed for in the first phase. The ability to re-structure and re-analyze the survey data will be much enhanced if it has been maintained in a flexible form.

5. Continuation of Survey

As is discussed in considerable detail in Part V of this report, there will be a requirement for a continuation of this survey effort if maximum benefit is to be obtained from the initial survey. As a "one-shot" task, the survey will quickly become dated, and thus no longer valuable as a guide to future tasks. Awareness of research throughout the Federal agencies, and industrial concerns as appropriate, should be maintained to stay abreast of the state-of-the-art and to apply techniques or results to Department of the Army problems.

H. Preparation of Final Report of First Phase

The specific details of format, kind and number of indexes and tabulations required for the final report of the First Phase should be worked out between the study team, the members of the Advisory Committee, and the Contracting Authority and can be modified as experience dictates for later revisions. In general, however, it will consist of the material described in the preceding section.

The survey should be viewed not so much as a one-time report, but as a part of a continuing review of recent advances and on-going research. A particular report cannot be expected to be accurate or relevant for a long period. This is true of any state-of-the-art report, and particularly true in a field so subject to change and technological advance as this one. In addition, it should be kept in mind that the function of this particular report is very specific. It is to form the basis for the later phases of the study project. Thus, while the published report may be distributed widely for information purposes, the basic design structure should not be compromised in order to make the survey more suitable for the general community. The function should dictate the form; accordingly, in the absence of compelling reasons otherwise, the survey should be prepared in the form most useful to those conducting the later phases of the total study.

III. SECOND PHASE: IDENTIFICATION OF PROBLEMS

A. Introduction 29

B. Identification of Problem Areas 31
  1. Missions and Externally Established Objectives 32
  2. Networks, Coordination, and Cooperation 36
  3. Objectives Established Internally by Technical Information Support Activities 41
  4. According to the Extent to which Good Management Practices are Followed 43

C. Specific Substantive Areas 45
  1. Sciences 47
  2. Technologies 48
  3. Functions 57
  4. Services 59
  5. Modes of Response 64
  6. Evaluations and Measures of Effectiveness 68
  7. Channels of Formal and Informal Communication 69

D. Specification of Problems within Problem Areas 69
  1. Literature search 72
  2. Opinions and recommendations 73
  3. Restatement of Problems in Terms of Specific Problem Areas 75

E. Restatement of Research Identified in First Phase in Terms of Specific Problem Areas 75

F. Select Problems Requiring Research and Distinguish Responsibility 76

III. SECOND PHASE: IDENTIFICATION OF PROBLEMS

A. Introduction

The second phase of the study project with whose design this report is concerned will be that of identifying problems in the library and information services areas and distinguishing between those which should be the peculiar province of DOD from those which should have multiple sponsorship and those which should be sponsored outside DOD.

This phase of the study project's work entails particularly difficult and significant responsibilities. Its recommendations could have a very influential effect on a broad range of research in library and information services. Unfortunately, no methodology dealing with the identification of problems has been developed such as that dealing with their solution despite the general acceptance of the aphorism that more than half the secret of success in research is asking the right questions. Therefore, between this design study and the study project itself, the required methodology must be developed. To outline such a methodology is the purpose of this section.

It would be nice to be able to find a truly objective, preferably quantitative, method to identify problems in such broad and variegated fields as library and information science and technology. Presumably, any such scheme would have to be based on various kinds and degrees of quantitative measures and non-quantitative, but hopefully objective, evaluations. It is tempting to consider trying to organize existing measures and means of evaluation into such a scheme. It should be possible to create a fairly impressive appearance of validity. Unfortunately, any such appearance must, except by accident, be false, simply because too little is known about the basic social, psychological and systematic factors involved to permit any reliable interpretation of the results of such measures and evaluations into the really important statements and conclusions that would determine problem selection. It must therefore be assumed that no such scheme can be devised at this time. (Even if it could there would not be enough time for test and validation to permit it to be used by the study project.) For present purposes, therefore, a considerable degree of subjectivity must be accepted. Such acceptance must not, however, be allowed to condone a reliance on personal biases or too ready an acceptance of "problems" which an individual--or his advisers--may have previously identified. Rather, the effort must be made to transmute whatever subjectivity cannot be avoided into "considered human judgment". In short, where objectivity cannot be assured, that fact should, if possible, be recognized, the possibility for influence by individual bias should be minimized and supporting information input to the human judgment processes should be maximized.

The major strategies here adopted to such ends are:

* By first identifying problem areas in which problems might--but do not necessarily--exist, a much more systematic and objective search for problems can be insured. Problems that are identified can be more easily related, when necessary, to other areas than the one in which they were first identified.

* Where possible a consensus of several judgments should be sought with respect to a candidate for designation as "a problem". The latest techniques for gathering and combining such a concensus should be utilized.

* Each problem identified should be considered in relation to the organizational framework involved. In particular the mission, objectives, tasks, etc. of the library or information service involved, and of higher,

lower, or coordinate organizations within the same Federal agency or military department should be considered.

* When there are interfaces with other organizations than those just indicated, these should be identified and taken into consideration.

* All candidates for designation as "a problem" should be considered in connection with the impact upon the individual human users that might result from their solution or non-solution. Those impacts should be studied for their effects on the organizational framework in which the individual users live and operate, particularly where performance of mission may be involved. If there are "machine-to-machine" interfaces such that what one automated system does might affect the performance of another, hence the performance of the organization in which the other automated system existed, then these interfaces must also be considered in evaluating possible impacts.

* Research identified in the First Phase state-of-the-art survey should be considered for its implications for this problem-identification phase. However, it must not be assumed prima facie that such research either identifies or is adequately responsive to a large proportion of problem areas that might be identified in the Second Phase effort.

* Opportunities to sub-optimize by objective means, e.g. by applying Operations Research techniques, to select between alternative statements of a problem should be used whenever possible.

B. Identification of Problem Areas

The purpose of identifying "problem areas" is to provide a framework for a systematic search over all recognizable segments of the overall library and information services picture in which problems might be expected to be found. This amounts to developing a special-purpose structuring, or classification, of the field. Looking at the field from different points of view will result in quite different structurings. Since each of these will have its own validity and may reveal problems not visible under a different structuring, we do not want to choose between them but rather use all of them that seem fruitful for our purpose. That is, we want a "faceted" classification rather than a hierarchical or "enumerative" classification. Since the purpose of this classification is only to build a foundation for the identification of problems, such niceties as elegance, exhaustiveness, and mutual exclusiveness, normally highly prized qualities of a classification, are not, in themselves, of importance. It would, for instance, be better to use both of two competing classifications than to spend time resolving their differences. For example, in Section II, reference was made to the use of a classification scheme in connection with the First Phase state-of-the-art survey. That scheme should be checked for possible implications in connection with this Second Phase problem area identification effort.

A general survey of the field to be covered by the study project is given below and in C. following. For convenience, such a structure as discussed above has had to be introduced. It, or one like it, could be used by the study project but should not be forced on it. For example, if it were felt that separable sets of problems would result from differences between libraries, information centers and technical information analysis centers, that should be considered.

1. Missions and Externally Established Objectives

Libraries and information services exist to satisfy certain needs of other organizations, normally at higher echelons in the organizational structure. It is especially vital to the success of the study whose design is here being developed that these relations be examined carefully. The highest priority in any program of research to resolve problems discovered must go to those which directly affect the ability of the libraries and information services to perform their assigned missions, tasks, functions, etc., which in turn support the missions, etc., of higher echelons of organization and, perhaps, other organizations dependent on them.

It will be essential in most cases to view the organizational picture in terms of systems, sub-systems and components, super-systems, cooperating systems, etc. But as in the case of classification structures such structuring in system terms must be subordinated to the basic objective of identifying problem areas. Ideally, each identified library and information system should be examined from this point of view. This would require at least obtaining opinions of the directors of the libraries and information services involved and of their immediate superiors as to the extent to which they are or might be contributing to higher echelon missions and identification of reasons for any alleged deficiency. It would also involve attempting to assess such contributions in terms of objective measures such as those proposed by the Institute for Advancement of Medical Communication.[21, 22, 23]

Unfortunately, the number of libraries and information centers involved is so large that this is precluded unless there is to be a considerable enlargement of the presently envisioned effort. As an alternative to such a 100% survey a random sampling should be undertaken. Presumably, such a random sampling should be stratified insofar as possible by such criteria as size, operational status, etc.

It must be recognized at the outset that in many cases it will be policies rather than technical problems which adversely affect the contributions of libraries and information services to other organizations. These policies may be internal or external to the library or information service involved. In such cases the study project should observe the adage "discretion is the better part of valor" if it is not to shut off all cooperation by the persons involved. The study project should not be expected nor permitted to do anything that could be mistaken for meddling in local administration. This constraint should not prevent the study project from being able to make a fairly accurate assessment of the extent to which policies rather than (technical) problems are in need of attention. If policies need to be discussed, the project should be able to state its case in general enough terms to avoid giving offense.

Assessments of contributions to higher echelon missions should address themselves to the problem under each of three different sets of criteria. These are identified briefly in the following sub-paragraphs.

a. Relative to Presently Stated Requirements The first and most important determination of whether or not there are problems concerning the fulfillment by libraries or information centers of their responsibilities must be made on the basis of their performance with respect to presently stated missions, functions, tasks, etc. If any considerable disparity between expectations and performances exist, the study project should decide which of these is out of line and, if possible, why. Since, when such disparities exist, there is danger that both reputations and morale may be low, leading to further deterioration and to masking of other problems, extreme tact and care may be required in attempting to understand the causes of such disparities.

b. Relative to Their Full Potential Under Existing Technology Because of the rapid progress of information science and technology, the considerable state of flux in the library world and the general lack of understanding on the part of persons not trained in library or information science, it is unlikely that there is a single case in which the missions, functions, tasks, etc., of the library or information service are actually specified in terms of what might be accomplished with full utilization of existing technology. This is a particularly fruitful area for contributions by the study project personnel. Again, while it cannot be expected that any sizeable proportion of the total libraries and information services can be studied in detail, it will be particularly important to select and study a representative cross-section. It is especially important that, in doing this, the project personnel not allow themselves to be carried away into making a systems analysis and new systems designs for those installations studied. Their role rather is to gain a general understanding of the factors causing the gap between present and potential performance. These factors may be technical, policy, education, budgetary, environmental, motivational, etc. While the understandings so gained may not turn out to be the most prolific sources of the project's eventual recommendations for specific research work units, they should, if properly analyzed and reported, constitute a particularly valuable by-product of the project as well as exercising general guidance and providing general wisdom for the formulation of the project's final recommendations.

c. Relative to Optimistic Projections This design study assumes that the bulk of the study project's recommendations will be derived from this area. The varied and multitudinous substantive areas which can be identified as problem areas will be more appropriately discussed in paragraph C. below. However, it is appropriate and vitally important to underline here the need to relate all such substantive problem areas--and any problems that may be called out in any of them--to the eventual contributions that will result to the missions, objectives, tasks, etc., which the respective libraries and information services exist to perform. These relations must be borne in mind and preserved, however implicitly, in the final recommendations.

The project must therefore act as an interpreter for the Army, DOD, or other Federal officials and organizations who are--or might be--served by libraries and information services. It must, on their behalf, communicate with those scientists and technologists concerned with the understandings, the means and the devices that can eventually upgrade or revolutionize the contributions to higher missions made by the libraries and information services components.

2. Networks, Coordination, and Cooperation

The greatest single challenge in the library and information service world today is the increasing impossibility for any single library or information center to achieve and maintain self-sufficiency. This is partly true because of the conceptual intertwining of sciences and technologies today to produce new disciplines at the interfaces of older ones (biochemistry, psycho-physics, magneto-hydrodynamics, etc.) and partly because of economic, military and political needs for mutual support and cooperation (budget limitations, triphibious warfare, regional alliances, etc.). Therefore, the highest priority, second only to directly mission-related problems, should be placed by the study project on any research which would assist the various separate technical information support activities to interact effectively with each other. Many kinds of interaction are possible. Union catalogs, interlibrary book loans and teletypes today foreshadow centralized purchasing and processing, on-line computer access to library material and closed circuit TV tomorrow. This line of thinking immediately implies networks and indeed any contributions towards the achievement of effective networks are well worthwhile attempting. However, without detracting from network research, the study project must avoid too narrow a view of networks as a goal which should be sought for its own sake. Networks will not be formed, or if formed will not be effectively used, without an underlying appreciation of their objectives, nature, capabilities, and limitations. A further essential is an honest predisposition on the part of organizations involved to contribute and cooperate as well as to benefit. Some of the considerations involved in cooperation at various levels of organizational hierarchy are discussed in the following.

a. Libraries and Information Centers A. F. Painter carefully explored the relations between the role of the Federal library and that of other information activities.[24] Her report clearly indicates that there is a lack of understanding of whatever similarities and differences there may be in the relative roles of libraries, special libraries, information analysis centers, information centers, etc. To the extent that this remains true effective interaction between these will be impaired and in some cases precluded. The study project should be able to make further contributions towards increasing such understanding and gaining wider acceptance thereof both by its own reports and by the eventual reports of research projects recommended by it. Among the factors that enter into the present situation are linguistic pragmatism, institutionalism, and the past and current decisions and determinations made by those in authority at all levels. It can be anticipated that defining specific problems susceptible to research in this area will be considerably more difficult than deciding that a problem area exists here!

Whether or not differences between types of organizations concerned with technical information create a deterrent to cooperation, the problem remains how to best achieve cooperative interaction between all such library and information service organizations within the Army, regardless of their type. To what extent is a basis for cooperative interaction or netting provided simply by virtue of the fact that they are Army organizations? How does this relate or compare to the basis provided by other factors such as geographic distance, organizational level, organizational similarity, similarity of subject coverage and similarity of organizational mission? Do questions of need-to-know or of security classification enter the picture? The first objective should be to identify all important factors that dispose toward or against the initial formation of networks or other cooperative arrangements since the hardest problem is, presumably, to overcome the many inertias and barriers to the initial establishment of such relations. Most of such factors will exist after netting or other cooperative arrangement have been established. These will not necessarily all work for or against continued effective exploitation of the arrangements in the same way they did with respect to initiating them. Therefore, here are further problems that should be considered but with a lower priority than those concerned with the initial establishment of arrangements.

b. Army and other Department of Defense Essentially, the same questions that were asked in the preceding sub-paragraph should be asked again in the larger context of the Department of Defense. Again, is the assumption valid that any Department of Defense technical information activity has more in common with another such than it has with any non-DOD technical information activity? If not, then can those bonds which are stronger than the DOD-commonality be made the basis of a viable network, or of other cooperative interaction? What effect, if any, will the issue of need-to-know and security classification have here? What role is played, or what effect is produced, by the operations or the existence of the Defense Documentation Center (DDC)? How will the "ARPA Network" fit into this picture. Would it constitute a nucleus around which a DOD network should be developed? Or does it rather constitute a model from which a different network or set of networks could be developed? If neither of these, what lessons, experience, or data might it provide?

c. Department of Defense and other Federal Yet another iteration of most of the preceding considerations must be made with respect to the entire Federal community of technical information systems and organizations. What are the factors predisposing toward interaction and cooperation and what are the factors predisposing against such? The roles of the Federal Clearinghouse and other organizations must be examined. At this level a new, important and essentially qualitatively different factor enters the picutre. That is the fact that a number of distinct, non-communicating, computer-based networks will have been in existence for some time by the time the study project can consider them. These include the NASA, AEC, National Library of Medicine, ERIC and other networks. At this point, if it has not already happened, the entire Pandora's box of technical compatibility must be raised on top of the problems of policy, mission, budget, physical proximity, etc., already emphasized. This certainly includes all the problems listed in connection with terminology in paragraph III.C.4.g. below. It also includes physical compatibility problems such as character set, bit representation of characters, number of channels on magnetic tape, number of bits per inch recorded on magnetic tape, and many more.

In particular, another new list of considerations that pertain particularly to such networks, and to networks of networks, will have to be identified, made explicit, and then investigated. Can two networks operating on different thesauri communicate by translation from the terms of one to the terms of another or is the only recourse that of standardization at a higher level, i.e. of developing yet another expensive super-thesaurus?

in what terms and/or in what manner can the content, the coverage, the point of view, etc. of different networks (or parts thereof) be described to each other for purposes of automatic interaction? To what extent can or should telecommunications facilities be shared? Especially, how will the many routine everyday determinations be made as to how to proceed once it has been determined that the required information cannot be provided from the organization to which the initial inquiry was addressed? This is perhaps the "sixty-four dollar question" and one that the study project should seriously consider as a candidate for research. Would, for example, organization A, of whom a query had been asked that it could not answer from its own resources, routinely turn to organization B simply because organization B was the closest, hence perhaps the cheapest, that it could communicate with? Or should it spend more money to turn to a different organization C, at a greater distance but where there was a higher probability of being able to produce the desired information, or at least a referral to some other organization D which could? On what can sub-optimizations in this area be based? What is best for organization A considering only its own needs probably will not be best for the overall network or groups of networks. For example, although in the preceding example it might cost organization A essentially nothing to always first find out if organization B could help, it might cost organization B dearly if many queries from organizations like A were routinely sent to it.

d. Federal and All Others While many of the same considerations as before must finally be reiterated at this level, there are qualitative differences. Perhaps the biggest single one is that this time academic institutions enter the picture. Many of these must be assumed to have an interest in developing regional, state, and national networks of library and information services, hence be willing and able to contribute research on more fundamental levels than can be expected of mission-oriented organizations in the Federal community. Also entering the picture will be commercial organizations which can be counted on to perform tasks, develop hardware, etc., if (and, normally, only if) they can expect to profit therefrom. At this level also questions will be raised as to the extent of the Federal Government's obligation to various aspects of network research, to information problems of state and local governments, to education, to small business, etc. In general, it would appear to be too complex a picture for this study project to tackle. Nevertheless, it should be aware of some of these possible ramifications.

It is recommended that, with respect to general network problems, per se, the agencies sponsoring this project also support and participate in the studies of network problems being undertaken by the American Library Association under USOE sponsorship. The study project should also maintain a close liaison with that study and be prepared to include in its purview any network problems that affect its sponsors which do not seem to be getting early enough or adequate attention by the ALA study. Especial attention should be paid to 1) increased sharing of resources, 2) development of national plans for purchasing and 3) use of modern computer, reproduction and telecommunications.

3. Objectives Established Internally by Technical Information Support Activities

Normally, in addition to the official stated missions, etc., which have been discussed in 1. above, each library and information service will have developed, either explicitly or implicitly, its own objectives, tasks, sub-tasks, work units, etc., which it conceives to be necessary and appropriate to the fulfilling of the externally imposed requirements. The completeness, quality and degree of explicitness of these internal objectives and guidelines and, especially, the degree to which the particular installation is meeting them constitutes another family of problem areas which should be considered by the study project. In general, these will be more directly relatable to the study project objectives of identifying problems since they will be stated more in the terminology of librarianship or information science and technology. Such objectives and the extents to which they are being met should certainly be considered in relation to the official missions, etc., discussed in 1. In addition, there are other criteria which should be applied in seeking to identify a problem area in this case. These are discussed below.

a. As Indicated By User Satisfaction In the final analysis any library or information service accomplishes its missions, objectives, tasks, etc., by means of satisfying very specific requirements of either personal or organizational users. In turn, satisfaction of the organizational user can also usually be expressed in terms of satisfying individual users. Recently special librarians and information scientists have made a prominent issue of user studies, and the satisfaction of the user in general. (See, for example, the chapters on this subject in each of the volumes of the Annual Review of Information Science and Technology.[3, 4, 5]) While the project will not be able to undertake direct assessments of user satisfaction this must, however, be kept in mind as a potential problem area and might well be made the subject of a specific research task recommendation.

A closely related but distinct problem area is the understanding of user needs--needs which the user himself is probably not aware of. These are covered in the references just given.

b. As Measured By Existing Measures A whole additional family of problem areas--perhaps several such families--may be identified as the establishment, validation, application, and reaction to, other means of measuring the extent to which libraries and information services perform the functions that they are supposed to, or at least commonly thought of as performing. In particular, those advanced by the Institute for the Advancement of Medical Communication show great promise and should be studied. They will be given an interesting test in connection with the Indiana State Library Studies.

c. As Assessed By The Impact They Are Making A most valuable measure of the extent to which librrries and information services are doing their job, would be to assess the impact they are making, i.e. the changes in organizational or individual behavior that they are causing. Evaluation of information systems from this "change-in-users'-behavior" point of view was discussed by Pratt [25] but not developed to any extent. This possible means of evaluating the worth and impact of libraries and information services is very poorly understood. The project should be alert for any opportunities to either increase or test that understanding.

4. According to the Extent to which Good Management Practices Are Followed

As in many other kinds of organizations poor management can vitiate the best efforts of good people with good equipment. Conversely, inspired management can accomplish wonders with mediocre resources. While the study project will not be, nor could it be, expected to attempt any kind of judgment of the management practices in the libraries and information centers it will contact, it must nevertheless make a conscious and determined effort to reach at least some general conclusions as to the extent to which problems in the management area are preventing libraries and information services from operating effectively.

For example, there are two "policy" areas which appear to cause considerable inefficiency in library and information center operations, and which should be useful areas of study. One of these is allocation of computer time to library functions. Impressions gathered from experience and conversations with others in the field suggest that two aspects are particularly troublesome. First, almost without exception, the effort required to fully program and implement any library/information retrieval function has been grossly underestimated, primarily because those doing the estimating have simply not understood the library's problems. Furthermore, once a system has been programmed and debugged, the library has often experienced extreme difficulty in obtaining enough firmly scheduled time to get the job done. Library computer runs often require significant amounts of time, especially set-up and printer time; operators tend to favor short-run "standard" jobs unless managerial pressure is exerted. Thus library jobs, in many cases requiring special paper and long run times, go to the bottom of the priority lists. This can cause serious disruption. If a library is dependent on a nightly run of circulation data, and has based its operation on the availability of a current circulation list at 0800 every working day, the circulation system simply will not work if that list is delayed to 1200 or 1400 hours. _Ad hoc_ temporary files must be constructed, then integrated somehow into the computer files, causing considerable difficulty and often making the system less efficient than the former manual method.

The second area of management "policy" problems involves procurement. The acquisition of library materials is an anomoly with respect to standard purchasing practice, but since libraries are presently forced to follow standard procurement procedures, much delay, expense and confusion results. This matter should certainly be considered by the study group.

C. Specific Substantive Areas

The fields of library science and information science are currently undergoing such a radical transition that the study project personnel are presented with an extremely difficult problem. On the one hand, it is obvious that the potential of existing technology to improve library and information services has barely begun to be tapped. Therefore, there is a tremendous temptation to say that the most significant problems are those which pertain to the harnessing of existing technology into present-day jobs. For example, merely the development of an inexpensive, portable, yet comfortable to use, microform reader may be a sine qua non to reap the benefits of the rest of microform technology. On the other hand, many highly respected authorities feel that we are on the brink of one or more break-throughs in the scientific and technological foundations of libraries and information services. Those break-throughs would result in such drastic advances and radical developments as to constitute a whole, qualitatively different, new ball game. If this is true, then the most significant problem areas are those which would hasten such developments.

The dilemma cannot be resolved on an EITHER-OR basis. The importance of effective information flows to the Army and other Defense Departments--and for that matter to other Federal agencies as well--is paramount. The possibility of making a wrong choice cannot be risked. Therefore, possibilities must be covered by research programs at this time. In effect, what the study project is being asked to do is BOTH prescribe for current ills AND prepare a detailed blueprint for the future. Continuous monitoring and re-evaluation must be relied upon to make appropriate adjustments in emphasis based on lessons learned and on general developments. This is treated in Section V. In the discussion of specific substantive areas both outlooks will be kept in mind, as they must also be by the study project.

The following discussion must not be considered to be a determination of problem areas. That is a task for the study project. Nevertheless, including such a discussion in this report seems to be the only feasible way of indicating the kind of approach required on the part of the study project. Similarly, the particular groupings of areas into what might be called "facets" or "points of view" in the following need not be adopted by the study project. It is, however, important that the study project follow the same general philosophy of looking at the field from different aspects and points of view, however they are named, and whatever sets be chosen.

To meaningful extent these different sets can be considered as being somewhat like the arguments of a Leontieff input-output model of the economy. In such a model cells are formed at the intersections of the arguments. The numbers in these indicate the contribution to one of the intersecting arguments from the other, hence also, inherently, the reverse (contributions from each of the arguments to each of the others). In the present case a multi-dimensional array would be formed. To illustrate, the technology of telecommunications might be considered to either draw from or contribute to in some sense a function such as acquisitions, a service such as current awareness, a mode of response to queries such as dialogue, etc. Since the development of the requisite theoretical and terminological bases for explicating, much less quantifying, such relationships cannot be expected within the time span to be covered by the study project, this design study must content itself with urging that the study project at least attempt to keep this model in mind as it proceeds with structuring the library and information science field into possible problem areas.

1. Sciences

There is a general unanimity of opinion that what the library and information science fields need most is underlying and unifying theory. This need was underlined by the first recommendation made in the Final Technical Report of the Case-Western Reserve University's Comparative Systems Laboratory: --

> "Most importantly, extensive work on a basic research level is suggested in order to develop theories and algorithms applying to the process of communication and all other processes involved in the operations of systems devoted to communication."[12]

However, the study project cannot be expected to detail the development of such theories. Such a course would be contrary both to the mission-oriented nature of most Federal organizations, hence of their particular needs with respect to information and library services, and to the basic characteristics of true science itself which defies prediction and scheduling. In general, these attempts must be left to the universities and to the few government agencies (NSF, USOE, etc.) with specific support missions related to them. This should not be construed as saying that the study project should not make any recommendations for research on theory. In general, the study project should emphasize applied rather than basic research. In addition to library science and information science, sciences or branches thereof which might contribute to present objectives include linguistics (especially semantics), psychology (particularly information-related behavior), sociology (especially the diffusion of new knowledge, customs, etc.) and mathematics (especially logic, propositional calculus, set theory, topology, and operations research).

Various aspects of terminology management should be considered as prime candidates for being designated as problem areas. The situation here was summarized succinctly by John P. Sharp: --

> "The problem of terminology and its control has been with us since the indexing and classification of information began. It forms...undoubtedly the greatest barrier to progress in solving the information retrieval problem"[28]

2. Technologies

In the process of attempting to identify areas in the technologies and sub-technologies in which research-worthy problems may be profitably sought, study project personnel must be particularly careful to keep in mind the dual approach discussed above, i.e. they must concern themselves both with the present and the future. As a generalization, it would appear that research intended to facilitate exploitation of present technology will not normally require progress in some other technology in order to be effective. On the other hand it would appear that research intended primarily to expedite the future will more often than not imply supporting or parallel advances in other technologies or methodologies and may well imply radical changes in general behaviors or ways of looking at things.

A very careful balance must be maintained in this respect by the study project personnel. On the one hand, they must steadfastly resist the temptation to indulge in wishful thinking without real basis. The study project should not be considered as one more opportunity to pursue the search of the "holy grail" of the "Memex" described in Vannevar Bush's seminal article in 1945 "As We May Think".[7] Sobering note should be taken of the fact that in over six years few of the expectations in the ALA report, The Library and Information Networks of the Future,[2] have come to pass. The Army, the other DOD departments and the Federal community of library and information services generally are in immediate and dire need of much higher pay-off than such a course would produce. This caution should not, however, be allowed to inhibit these or any other recommendations for research if the study project feels they are warranted.

a. Computers Basic computer technology, i.e. the general advancement of the computer technology state-of-the-art without particular reference to library and information services, should not be considered a legitimate expenditure of TISAP resources. This should be left to the computer sciences themselves. However, adaptions and applications for library and information services clearly warrant attention. The study project should, in the hardware area, consider at least the following as possible contenders for identification as problem areas:

* The implications of large cheap storages of various kinds.

* The implications of optical character recognition input means from either hard copy or microfilm.

* The possible value of special purpose hardware designed for repetitive library and information services tasks either "stand alone" or as an input/output terminal, or better, both.

* A capability which would permit an individual researcher or student to copy selected words, sentences, etc., directly from the printed page into the computer store without intermediate handwriting or printing.

In the software area among those considered should be the following:

* The need for the development of a special problem-oriented language for the library and information services field.

* Comparative evaluations of existing languages, both from the point of view of ease of learning, of capabilities, and of requirements for programming and machine running time.

Other matters concerning computers will be discussed at appropriate places in the rest of this section.

b. Telecommunications A truly significant and effective exploitation of telecommunications technology to some of the core problems of library and information services has long seemed to be an attractive and reasonable goal, but like the pot of gold at the end of the rainbow seems to have remained tantalizingly out of reach. While both TWX and facsimile transmissions of various kinds have been tested and some made operational, their impact has been most disappointing. In principal, telecommunications of one or more varieties should make possible the realization of truly effective networks of libraries and information services, in fact such a use is intrinsic in today's anticipation of such networks. This is certainly one problem area and should be a high priority matter for the study project. If, as may be hoped, the study project itself can identify the specific problems that seem to be holding up progress, then it can prescribe the necessary research tasks to solve these problems. If not then it would seem almost a foregone conclusion that some research should be prescribed that would offer hope of determining just what problems are causing the difficulty. In the process, consideration of the possibility of using television, particularly if it could be used concurrently with standard broadcasts, to transmit page images to remote devices which could record, and at option print, such images would seem to be in order.

c. Microforms Is the sudden explosive growth in the use of microform, especially microfiche, as a medium of making research results available throughout the research community a breakthrough or a disaster? Considering the day-to-day routine of research and scholarly activities, rather than special circumstances that would favor the use of microforms, what would be the effect on information input on the part of the using population if a hardcopy collection were suddenly totally replaced by a microfiche collection of the same material? What would be the eventual effect on the nature of the user population itself? Are generalizable answers to such questions possible? If not then under what circumstances are microfiche beneficial and when are they detrimental? Or are these indeed significant questions at all? The study project must make up its mind about such questions. With respect to those it deemed significant it must decide whether on-going research will suffice to provide the needed answers or whether additional research is necessary.

As previously mentioned, one somewhat widely held belief is that the availability of a low-cost, truly portable, perhaps lap-holdable microfiche reader might make all the difference in the world with respect to the utilization of microfiche as a medium for carrying information. It is such propositions as this that the study project must ferret out, rephrase into forms amenable to answering, and, keeping in mind the results of the First Phase decide whether or not the problem is one worthy of further expenditure of investigative resources.

All the questions asked so far with respect to regular microfiche and more should be asked with respect to the relatively untested ultra-microfiche. There seems no question that importantly larger amounts of material can be provided, at considerably lower cost per item and taking much less space. But there may well be valid questions as to how much use such collections will get, by what kinds of users, and under what circumstances.

Yet another aspect of the microform picture that must be given careful consideration by the study project is the relatively brand new computer-to-microform technology. Does this development itself provide any possible answer for other problems in the library and information service area? Does it raise any new problems? If so, are they problems of concern to the Federal community or should developments be watched for a while more before expending Federal research resources in this area?

d. Reprography Assuming reprography to apply to the reproduction of microforms as well as of hardcopy, the implications of decreasing cost and increasing speed--and perhaps of decreasing size--need to be considered by the study project as candidates for problem areas. Rapid changes in this field make it appropriate to re-ask the same questions from time to time. For example, the concept of the "D Library" proposed by Heilprin[14] may have a renewed currency. At least one organization, the North American Rockwell Corporation, gives away, rather than lends, microfiche of requested reports. Some consideration has been given to using the complete microfiche of a report as the current awareness announcement (normally as part of the operation of a selective dissemination of information (SDI) system), letting the recipient simply throw the microfiche away if he is not interested. Under what circumstances should the Army or other Federal libraries and information services consider adopting such practices? Under what circumstances, if any, might they be adopted for use with hardcopy instead of, or in addition to, microfiche?

The complex of information analysis centers at Battelle Memorial Institute have achieved remarkable success with a technique which involves multiple reproduction of hardcopy 5x8 cards containing extracts of the most significant information content of the documents input to the system. Would other forms of reprography, perhaps in combination with other technologies, make a similar system feasible or desirable for Army technical information users who might differ from the rather specialized type of combination scientist-information scientist who characteristically uses the Battelle files?

e. Storage Storage limitations are a frequent constraint in the entire library and information service picture, from shelving space for the whole library down to computer core space or simply numbers of filing cabinets. Many of these constraints might, for all practical purposes, vanish as extremely large computer stores, such as the "trillion bit store" recently developed by IBM, become available at prices that the average installation might afford. Can they really be expected to? If so, will they be used in the library and information world to store more bibliographic material, to store full text, or what? Would such developments create further need for the computer-to-microform technology? These are among the questions relating to storage that should be considered by the study project in identifying problem areas. As few more specific considerations are given below:

(1) Files and filing In the heat of its pursuit of exotic new technologies for research problems to be identified in the library and information service field, the study project must also keep within its sight such mundane matters as files and filing arrangements for hardcopy, cards, etc. These may still be one of the more important determiners of efficiency or effectiveness in many libraries. Choices have to be made between various types of files such as vertical, elevator, front access, rotary, cardex, and various kinds of drawers. Are these simply functions that should be left to the discretion of individual managements? Or are these possible problem areas in which one or more problems worthy of research might be found?

(2) Shelving Another unglamorous area that should not be overlooked is that of shelving. Are studies needed to determine when compact shelving is better than normal shelving? Is the feasibility/

desirability of using some new automated book "paging" system such as the Randtriever so well known or so easily determined or so insignificant a question as to be unworthy of being considered a candidate for problemhood?

(3) Magnetic It would not seem that problems of magnetic storage per se are generally of direct concern to the Federal library and information service community. That is not to say that magnetic storages are not important! However, problems in connection with them would seem to be better left to the computer science and technology people as far as hardware development is concerned and to the specific systems designers for library automation systems or information processing systems when it comes to applications. Two exceptions seem worthy of mention. One is that the intellectual organization of information to best utilize different kinds and sizes of magnetic storages might well be considered as a problem area. If so, however, it probably should be considered in connection with information science rather than magnetic storage technology. There is, however, one area in which the library and information service people might well consider magnetic storage to pose problems of direct relevance to them. This is the question of how best to store analog and facsimile information in magnetic storages. Its importance may be inferred from the fact that it was chosen as the sole topic of discussion for a one and one-half day special-invitation meeting of experts preceding the Fall, 1967 meeting of EDUCOM. More heat than light was generated by that special meeting suggesting that the problem is neither simple nor solved.

(4) Photographic The use of photographic techniques has already been mentioned in connection with microforms and reprography. Another application is to the storage of computer-usable material as

in the "trillion bit memory" already referred to. The possible implications of the wide spread use of such "read only" stores that would permit little or no updating or changing could be considered by the study project as a possible candidate for some research effort.

(5) Holographic The study project should also consider other potential mechanisms and techniques for large or associative or rapid access storages. One that should be looked into to some extent is the newly developed technique of holography. By the time this study project is into the Second Phase sufficient time should have been available to have carried holography through its first laboratory stages and a reasonably well-grounded assessment of its potential for library and information service applications should be possible.

f. Audio-Visual Another development in the library and information services field was highlighted by the recent announcement of a request for a proposal by the National Library of Medicine to develop a classification and other tools for organizing and managing its National Medical Audiovisual Center in Atlanta, Georgia.[19] In the lower echelons of education at least, many libraries are being renamed and restructured as multi-media centers, materials centers, etc. The study project should consider whether or not this development is significant in the Army or general Federal community context and if so list it as a possible problem area.

g. Computer-Assisted Instruction There seems little doubt that computer-assisted instruction (CAI) is "here to stay." As CAI spreads to higher levels of education and is applied to more and more subjects it will take on more and more of the aspects of the large information store. An example already operational at the Harvard Visual Information Center is the use of CAI to assist the uninitiated in learning to use the computer based retrieval system itself. It would also seem that, increasingly, the CAI developed dialogues between a student and the teaching system will resemble the information systems-developed dialogues between an information-seeking researcher and the information system. Also it seems probable that under many circumstances a library or information center may be the logical, perhaps the only, place to locate any CAI facilities that might be offered. This possibility is further heightened by the likelihood that CAI may develop an increasing interface with audio-visual techniques and with information retrieval techniques.

h. Libraries and Information Centers as Education Centers A third trend, more closely related to the audio-visual and CAI areas than to the other technologies previously discussed, is the possibility that libraries and information centers may be increasingly looked on as education centers per se. This would be more likely to happen in an organization that did not have a separate education function designated and separately housed, but could develop even in these. The library has, of course, traditionally been the place where the "self-made" or "self-educated" man has gone to further his own education. Both A-V and CAI would further support and facilitate this kind of use of a library. What really highlights this possibility, however, are the proposals such as that described recently by Karl L. Zinn[33] : --

> "I believe that in this mode students could accomplish more scholarly work of greater quality during a given period of study, and acquire more skill in searching for and organizing information, than through discontinuous encounters with structured and strictly controlled tutorial instruction interspersed with periods of independent study. I am intrigued by development of curriculum files for this mode because the role of the subject expert is shifted from the detailed writing of a step-by-step introduction for a topic, to the assembly of an appropriate data base for student exploration, and to consultation on the development of powerful aids for exploration and scholarly work within those files of information."

The study project should carefully consider the usefulness or the likelihood of such a development in the Army, the other military services, or the Federal information community at large, and be guided in its selection of problem areas accordingly.

3. Functions

A wholly different way of slicing the library and information services picture is to consider it in terms of the functions, such as acquisition, cataloging, circulation, etc., into which the day-to-day operating routines of people who work in libraries--and to a large extent people who work in information centers--are organized. These functions, frequently referred to in the library world as "technical services" are usually the basis for the major organizational subdivision of libraries, i.e. into an Acquisitions (or Ordering) Department, a Cataloging Department, etc. Studying the library and information services picture from the viewpoint of these functions will enable problem areas to be recognized that would otherwise be missed. Operational patterns will be emphasized and the technologies will be brought into the picture in terms of capabilities, capacities, costs, etc., incidental to supporting such operations. Also new emphasis will be placed on such methodologies as operations research, systems analysis and design, systems integration, etc. In considering this area of functions the study project should particularly concentrate on viewing the library or the information center as a system with its included sub-systems, components, etc. When, later, the library or information center is considered from other points of view, it will be looked on as a sub-system or a component of some larger system.

The tremendous promise held forth in terms of applying the latest technologies, particularly those discussed in 2. above (computers, telecommunications, etc.) usually seems to carry with it the requirement that the various functions traditionally recognized as the basis for departmentalization must be placed in perspective with respect to each other and to a whole hierarchy of larger pictures. The first level at which this must be done is within the library or information center itself. To the credit of responsible Army personnel who developed the TISAP program from the predecessor ATLIS program, the timing of such a study by the study project will be just about right. In particular a number of important programs which directly or indirectly test theories and procedures of automating and integrating library functions will have had time to become operational to some extent and to have been tried out in practice. The Alpha-2 program at Redstone Arsenal is one such. The MARC II project of the Library of Congress will have been publicly available long enough to test some of its concepts having direct implications for many of the traditional library functions. Other developments, outside of the microcosm of the individual library or information center, which hold tremendous portent for them and which would appear to have had just about the right amount of time to yield usable test results include the issuance of the ERIC tapes routinely, initiation of the NASA RECON information network, the inauguration of NLM's Bio-medical network, the AEC network and the ARPA network. These and many more, both within and outside of the Federal community, must be examined for their implications, singly and collectively, for the initiation of further research to benefit the technical information support activities of the Army and other Federal agencies. In the process, the plans and estimated prospects of other organizations whose results will be available to Army and other Federal libraries and information installations, must be taken into account. These include such organizations as the LARC ASSOCIATION, EDUCOM, SUNY Network, and Projects INTREX and MAC at M.I.T. Although it would not be appropriate in this report to consider each of the functions at length, they must be so considered by the study project. A recent comment by Ervin J. Gaines illustrates the thinking that must be taken into account:

> "Circulation control is a cumbersome and time-consuming effort in most libraries, with a perfectly Byzantine labyrinth of records of petty offenses and paper snares designed to catch culprits. A cost-effectiveness approach I am convinced, will demonstrate that these controls are not worth the effort of retaining them, and I submit that they emmanate from two convictions: (1) that a book is a precious commodity which the library dare not lose and (2) that we must exercise some kind of police function over patrons.
>
> In technical processing we are only beginning to see that our painstaking efforts at precision in setting up bibliographic control are largely ignored by the users. Tailor-made cataloging and classification for each library are less justifiable with each passing year. Wider use of nationally prepared finding systems will reduce the economic input at the local level without seriously impairing library effectiveness."[11]

4. Services

Another important way to consider the library or information center is to look at its products, both separately and collectively. These products constitute the output of the organization viewed as a system or system component, hence inputs to some other entity. The important products are "services," not to be confused with the term "technical services" which describes self-serving internal functions, like acquisition and cataloging. The study project may well decide that this facet, services, should be considered in conjunction with missions and objectives discussed in B.1. and B.3. What is important is that the study project at some time take an explicit and comprehensive look at services as such. Some of the possible services that need to be considered are mentioned briefly below.

a. Loan It will help to take a fresh view if the loan service as a "service" is considered separately from "circulation" if the latter were thought of in terms of what goes on inside the library. "Loan" can be thought of primarily as a product, a service which is to be considered in terms of its effect, impact, satisfaction, etc., with respect to the user himself. It has already been suggested that in some instances loans should be replaced by outright gift or distribution as the case may be. In most cases, however, loans will still be part of the service expected of a library--less so of some information centers. (consider audio-visual materials.) And is there any adult counterpart of the "materials center" concept being developed in some school libraries where, in some cases, even animals have been loaned?! Such large deviations from the traditional library image must be accepted as at least conceivable by the study project, and its search for problem areas must be conducted accordingly.

b. Issue By "issue" is meant a gift or distribution of material without expectation of return. As suggested by Gaines in the quotation given earlier, cost-effectiveness should be applied here, both in assessing the success of existing services of this particular kind as well as envisioning future such services. If the study project finds itself impressed with the present success and future promise of such a service it must then ask what problems are now deterring a more widespread offering of one or more kinds of issue service?

c. Reference and Referral The reference service is the only one of the traditional services that can really appropriately be discussed under the present general heading of "Services." It is likely, however, that the study project will only be concerned with the "special library" or information center kind of service in this respect, including referral to other sources of information or expertise. Particular attention should be given to the possibility of providing the user with automated assistance, probably with an associated visual display, in his search for guidance to useful material. The project should familiarize itself with the capabilities of the NASA RECON system in this connection, also with progress being made by MIT's INTREX towards the development of its "augmented catalog". Then the study project should consider the potential of such measures in the general Federal library and information service picture.

d. Selective Dissemination of Information (SDI) Clearly the study project must give special attention to the so-called "selective dissemination of information" (SDI). Even though what is disseminated in the typical SDI system today is not information but rather a reference to some artifact containing information, this can constitute a very important service. Among the questions that should be entertained by the study project in this connection are the following:

* Should any or all libraries attempt to provide SDI services or should the provision of such services be, where possible, assigned to one or a few libraries or centers that are particularly well equipped or staffed to provide that service, especially when either a particular user population or a particular subject area is involved?

* Is enough known, or under study, about what the best form of an SDI notification should be? E.g., should it contain an abstract? --descriptors?

* The same with respect to form of feedback mechanisms.

* Are any systems of automatic "profile" generation or updating satisfactory (such as the one developed at Ames Research Laboratory, Ames, Iowa)? [27]

* Especially has or could the SDI concept be applied to actual data or information as distinguished from bibliographic references? In particular could it be applied to the products of the Standard Reference Data System of the Bureau of Standards? To any comparable material?

* Has any study been directly addressed to the cost-effectiveness tradeoffs between individual and group SDI?

* What role if any should Federal libraries or information services play in the distribution of preprints by an SDI-like mechanism as proposed by Libbey and Zaltman.[16]

* Are terminology control systems vital to an automated SDI system? If so, of what nature?

e. State-of-the-art reviews According to some, professionally written state-of-the-art reviews are among the most needed products that might be produced by an information service. While this is too complex an area for the study project to address itself to directly, it should at least consider whether or not there is an immediate need for further study or studies in this problem area.

f. Current awareness Certainly current awareness services in addition to SDI already discussed are among the most important that can be offered by Federal libraries and information services. Are there adequate means whereby library and information service personnel can judge the adequacy of existing current awareness services or whether new or revised services should be offered? Is the contribution of the Federal library and information services community to the work of the National Federation of Science Abstracting and Indexing Services (NFSAIS) commensurate with its (the Federal community's) needs? Its obligations? Is there, or can there easily be developed, any formula indicating, in cost-effectiveness terms, the current awareness services to which any given library or information service should "subscribe" in order to adequately service its clientele? The term "subscribe" must be considered to include free subscriptions since the actual costs involved include not only any monetary outlay for subscriptions but also the costs of processing to the point where a product usable by the clientele has been produced. This question applies both to the kinds of current awareness services represented by the magnetic tapes to be provided by MARC, ERIC, AEC and others, and to commercial services such as those provided by the Institute for Scientific Information, Inc. and PANDEX. Many terminology control aspects here are generally similar to those discussed in the context of retrospective searches in the next section.

g. Retrospective searches Another service of fundamental importance to the users of library and information services is the retrospective search, whether performed manually, automatically or by some combination and whether the product of the search is bibliographic references, the documents themselves or the information or data itself. The number and variety of different combinations of approaches, systems, equipment, users, subject fields, and many more parameters is far too great to admit of any exhaustive treatment by the study project on a case by case basis. However, the many problem areas involved are so central and so urgent to the entire library and information picture that they must be faced. Perhaps the greatest single technical challenge to the skills of the study project personnel will be to come up with a sufficiently inclusive, balanced, yet incisive and effective assessment of the state-of-the-art in this area to determine needs for further research. Among other things the following list should receive attention. This list also applies to current awareness services:

* In general are terminology control measures adequate? Overdone?

* Does the thesaurus-based approach appear to be accomplishing its objectives?

* Are the costs of developing and maintaining these large thesauri justified?

* Is there any way to compare the effectiveness of different kinds of thesauri? If not, is such needed?

* Does there appear to be any better method in sight than the thesaurus-based approach? If so, is research on it commensurate with its promise?

h. Other There are many other services that are being or could be offered by libraries and information services. Some of these such as offering translations are somewhat outside of the usual library and information services field. Others, like the preparation of personal bibliographies for specific subjects, are not. The importance of the services point of view is so great that it is imperative that the study project exercise particular care to insure that any problem areas therein are identified.

5. Modes of Response to Queries

There is yet another way to categorize libraries or information services which, though inexact, is particularly useful in some ways. It is more applicable to information services, especially automated ones, than to libraries. The Institute of Library Research at UCLA identified three types of output from systems which respond to queries.[29] These plus two more, farther along a scale roughly related to "usefulness", constitute this categorization which for want of a better term will be called Modes of Response. The Mode of Response given by a system is not simply important as a mark of how sophisticated it is. It is also important in terms of its appropriateness for the user of that system. For example, it appears that for many kinds of legal work nothing short of full-text would be useful. In such a case the best possible reference retrieval system would not be satisfactory. In other cases the need may be for a system which produces the actual data of concern rather than some pointer to a document containing that data. Airline reservations is an example. It would be too much to expect the study project to elucidate the specific problem areas here; the whole question is too little understood as yet. It should, however, remain alert for results, research, or indications of specific problems in this area. Since this particular categorization is not a common one in the profession, each of the modes are discussed briefly below:

a. Reference Retrieval This is the mode of response to queries by most so-called "information retrieval systems" today. There is no questioning the usefulness of such systems in enabling better use of and access to the mountain of information that is accumulating. There is much more to learn about how such systems can be made more effective and the price of learning will be well worth paying. It is to be expected that some of the research projects called out as a result of the Third Phase of the study project will be directed to this purpose.

b. Data Systems, especially automated systems, that respond to queries with the actual data that is desired are in a somewhat paradoxical position at the moment. In some ways, they predate the earliest "information retrieval systems" in that the business data processing applications which constitute the second "application generation" of computers (scientific data processing applications being the first) are to some extent "data retrieval systems". Yet in another sense data is a special form of information and we are still generally some distance away from being able to develop automated systems that return the actual information desired in response to queries. What distinguishes the two is that in the former case the only data that can be retrieved is that for which a need was foreseen and for which explicit provision had been made, whereas in the latter case what is desired is the capability of the system to retrieve data for which a need had not been explicitly foreseen. The typical "data retrieval system" of today can be thought of in terms of the airline reservation systems, the systems being developed by the chemical, pharmaceutical and bio-medical communities and systems that would use the data being compiled by the National Standard Reference Data System. Data in this sense carries one or more of the following connotations: numerical or alphanumerical values or states or results of some physical or conceptual system process operation, information that is normally highly formatted, and information that is normally expressed in tabulated form.

c. Full-text As has already been mentioned, a system capability of being able to retrieve full-text in response to a query has already been found useful, at least by several investigators working on applications in the legal or statutory field. With continuing reduction in the cost of storing and retrieving full-text, the study project should make an effort to understand why the full-text retrieval capability is desirable in this or any other particular field, and whether or not there are any reasons why it should be more feasible in one field than any other. Could it be, for example, that the sine qua non for a successful full-text retrieval system is a voluminous and detailed concordance and that the legal field is simply ahead of others in accepting that necessity because in Shepard's Citations, it has already become accustomed to using such concordances?

It should be noted that "full-text" is often used to refer to the full-text of abstracts as well as, or in addition to, the text of the main body of an article. The study project should also consider the possibility that full-text retrieval is needed in management information system applications. If it is, it might well be combined with library and information service systems to perform not only a technical information support function, but also an administrative support function. As an example, the full-text of the Army regulatory articles, the DOD regulations, etc., in certain specific areas might be made available to managers who so desired.

It should also be noted that at least one commercial time-sharing system specifically designed to handle full-text through remote access terminals is available. The study project should investigate at first hand, perferably through its own use, the capabilities, advantages and disadvantages of such systems.

d. Information By "information" as a mode of response to queries is meant the actual presentation to the querier of the information he is seeking whether or not it previously existed in the computer-usable storage in exactly the sought form. Semantic and/or syntactic analysis in the course of routine information processing to respond to a query in this mode is implied. Automatic indexing and automatic abstracting are precursors of this mode of query response and are additionally valuable in their own right. Eventual attainment of such a capability on a general scale seems inevitable. However, the cost in research to reach it will be high as will the first time cost of making such a capability operational (computer hardware, programming, and storage costs and the costs of preparing and inputting the required data bases). Therefore, although research along such lines might properly be supported by such Federal organizations as NSF and USOE, the study project would only be justified in identifying research projects in this area under Army or DOD sponsorship if it felt it could foresee specific needs for such a capability.

e. Dialogue By "dialogue" is meant a fullscale, real-time, verbal interaction, presumably in some natural language or subset thereof, between a human and an automated information system, which incorporates the capability discussed above for information response. Whereas the latter (information mode) will embrace a range of capabilities extending from, say, automatic indexing, an activity which cannot really be considered, the former (dialogue mode) will be essentially entirely "artificial intelligence" oriented. Pseudo-dialogues such as have been simulated in narrow areas by incorporating further sophistication, additional paradigms, etc., can expedite progress toward the eventual capability.

The remarks made with respect to research on the information mode can be applied even more rigorously to research on the dialogue mode. It should not be recommended by the study project unless a fairly clear need for such a capability is in sight.

6. Evaluations and Measures of Effectiveness

One of the greatest weaknesses in the general field of library and information services today is the impossibility of evaluating them or assessing their cost-effectiveness. In general, these questions have been taken up from time to time during the preceding discussions. They do need the emphasis of separate mention, however, and the study project should consider the problem area as such in addition to considering it where appropriate in relation to specific questions. When considered in its own right, one of the questions the study project should consider is the extent to which the practice of charging users for services rendered can be relied upon to provide valid measures of effectiveness.

7. Channels of Formal and Informal Communication

The problem of determining--or creating--the channel of communication most appropriate for the needs of individual or collective users is another important potential problem area that needs to be taken up by the study project. Alternatives include personal visits, telephones, letters, preprints, journal articles, reports, newspapers, monographs and many more. In particular, the problem of communication outside the established literature as discussed in Reference 1 needs to be studied.

D. Specification of Problems within Problem Areas

Inevitably some specific problems will come--or be brought--to the attention of the study project personnel during the time when the project's primary concern is the effort to identify problem areas. The study project personnel must, of course, make note of such instances for later use. However, if the objectivity hoped for is to be realized such diversions from the problem area identification effort should be held to a minimum. Another reason for attempting to keep the problem area identification effort separate from the actual problem identification effort itself and preceding it in time is that this will tend to insure that when a specific candidate for designation as "a problem" is discussed it will be looked at from various other points of view than the one which led to its being proposed.

When the project director feels that adequate effort has been devoted to the identification of problem areas, the primary objective must be shifted to the identification and definition of specific problems. The degree to which the study project personnel can develop and maintain a high quality of "problem-seeking behavior" (as distinguished from the more familiar "problem-solving behavior") will determine the success of the entire study project. To keep these two separated, i.e. problem-seeking and problem-solving, will be as difficult as it is important. It will be _difficult_ because most people have subconscious tendencies to avoid recognizing as problems those which they feel might be difficult or impossible of solution. It is _important_ in that wise allocations of priorities and of available resources among problems cannot be made unless all of the important problems which might affect the probability of success of a particular research project are explicitly presented for inclusion in the decision-making process.

To make a problem statement more useful certain characteristics are desirable.

* _It must be specific_. That is, it must not be simply a statement of identification of a "problem area" in the sense used in Section C preceding. Thus such a general statement as "Microform technology is an important problem" is inadequate.

* _It should be an informative statement of a fact as seen by the study project_. This fact could be stated either negatively or positively. For example, either the statement,"There is no generally acceptable portable microfiche reader available for under $100." or a positive version "An acceptable portable microfiche reader costing under $100 is needed." would do.

* _It should name a problem that the study project feels could be solved_--or at least tackled--by a single project or program established in some single organization and preferably within the domain of some single discipline or technology.

* It should avoid implying a particular solution or approach, and even more should avoid detailing such. Keeping these separate as a task to be accomplished by the Third Phase of the study project, as wisely called for in the basic concept of the study project on the part of the Army/Federal Library Committee personnel, is an important element of the attempt to attain and maintain the maximum objectivity throughout the work of the entire study project, and should be carefully supported.

* It should not be stated in terms of a particular person, organization, or project. For example, one of the two problem statements previously given with reference to a microfiche reader would be preferable to the statement, "the Alpha-II program at Redstone Arsenal requires that an acceptable, portable microfiche reader costing under $100 be developed".

The foregoing are desiderata, not requirements. If the study project feels that there exists a problem which needs to be identified, then it should state that problem in the best way it can, regardless of the foregoing.

An operational hazard must be pointed out and avoided by the study project where possible. Since, in the final analysis, most information problems deal with words, the project study personnel will be using words to talk about words. Worse, they will be concerned with information about information! In all such cases, there are various tendencies--most of which are never explicitly recognized by those concerned--to semantic confusions of various kinds. Confusions between cause and effect, substance and process, levels of abstraction, and degrees of recursiveness, are among the forms most often found. Consider, as an example, the particular methodology of problem identification developed by the present report. This, presumably, will be passed to the study project as a guide. Whatever the study project does, whether consciously and intentionally or not, constitutes another methodology for identification of problems, certainly different in some respects. Should the study project decide to write a separate report or a part of its final report on the methodology of problem identification based on its experiences, this will be yet another. And finally, the study project might well choose to identify "methodology of problem identification" as a "problem area" and then identify specific "problems" within that "problem area" on which it recommends research.

Some of the more specific steps that should be undertaken by the study project in the process of problem identification are discussed in the next three sub-paragraphs.

1. Literature search

It is essential that competent identification of problems in the library and information areas that have been stated in the formal literature be recovered and explicitly introduced into the deliberations of the study project. The essentiality of this is due to the extreme ubiquity and breadth of the fields being addressed. It is difficult or impossible to prescribe an exact paradigm for this search. It is safe to state, however, that it will be different from a literature survey for research in the library and information fields, although there is no reason that the two might not be undertaken concurrently There are many valuable contributions in the literature towards the identification of problems which would not be recovered in the course of any survey of research. The following are given merely as an indication of the kinds of information of this sort which are to be found:

* Twenty-one problems were defined by Vernon Clapp in The Future of the Research Library [9]

* Eight problems were defined in The Human Sciences Research, Inc. report, Methodology for Test and Evaluation of Document Retrieval Systems: A Critical Review and Recommendations.[15]

* The May 1967 issue of the Wilson Library Bulletin contained some 25 articles on library research by particularly qualified contributors. Many problems of varying degrees of specificity are identified in these articles.

* Forty-three "Problems Requiring Attention" were discussed in Appendix A. of "Proceedings of the Forum of Federally Supported Information Analysis Centers"[26]

* Five rather broad areas were discussed by the System Development Corporation.[31]

* Eight recommendations were made by Goldwyn et al. (see Reference 12)

Therefore, at least part of this literature survey should be conducted simultaneously with the First Phase survey, but two distinct lists must be maintained of the products thereof: one of research to be used in the First Phase, the other of problem identifications to be used here.

All problem statements found or implied are to be recorded as completely as possible together with complete bibliographic information to enable a return to them at will.

2. Opinions and recommendations

None of the problem statements or problem identifications mentioned heretofore can be accepted by the study project for inclusion directly in its final report on identification of problems. Rather they are all intended to serve in the nature of a check list to insure that as little as possible is overlooked, and to further stimulate the thinking and imagination of the study project personnel. For various reasons, including 1) competence, 2) currency, and 3) the fact that many are probably not to be found in the literature, the following are to be regarded as the primary source of problem identifications: --

a. Study project staff Obviously the principal source of identifications of problems will be those made by the study project staff on the basis of a painstaking review of each and every problem area it had previously identified. In the process of the review, all possible measures should be taken to reduce the effect of personal bias. One such would be to have the person or persons who reviewed a given problem area present their conclusions as to the specific problems that should be identified therein to the rest of the project staff and perhaps other qualified persons for general discussion. In addition or instead of this a "brain-storming" session involving as many of the project staff and other qualified persons as possible should be held specifically on each of as many "problem areas" as possible.

b. Army In cooperation with Army personnel in the Office, Chief of Engineers, the Advisory Committee and the FLC, as many U.S. Army persons as possible, both military, civilian and contractor, should be approached for their opinions and recommendations as to problem identification. While many opinions and recommendations from such persons will have already been gathered incidental to the identification of "problem areas", further discussions, oriented more specifically toward the identification of problems, will need to be scheduled. In line with previous discussions, the list of personnel to be so approached should not be limited to persons in the library or information fields, but should in addition include affected persons in higher echelons or in other organizations served.

c. Other Department of Defense On the assumption that the commonality between the various Department of Defense agencies is stronger than that existing between other Federal agencies, an expansion of the same approach of seeking opinions and recommendations to include other Department of Defense agencies should be undertaken next. Remarks under b. above still apply.

d. Federal (including FLC, COSATI, etc.) A similar further expansion should then be undertaken to include competent personnel in Federal agencies outside of the Department of Defense. Remarks in b. above also apply here.

e. All others A final further expansion of such approaches must be undertaken to include at least representative contributions from the academic world and from the business world.

3. Restatement of Problems In Terms of Specific Problem Areas

As a final step in the specification of problems, all those that resulted from the previous procedures or any others the study project undertook, should be restated in terms of the specific problem areas that were previously identified. By this is meant not merely identifying a specific named problem with a specific named problem area, but also indicating other problem areas that it could be related to either in the sense of affecting or being affected by such problem areas. This step will conclude the specific effort to identify problems and will organize the results of that effort so that they may be screened against the results of the First Phase.

E. Restatement of Research Identified in First Phase In Terms of Specific Problem Areas

In order to enable the identified problems to be screened against research in progress--or recently completed--which might reveal that the research required to tackle specific problems is in some cases already adequately in hand, the best directory of such research available to the study project must be categorized in terms of the problem areas developed in accordance with III.B. and C. The information gathered by the study project in its performance of the First Phase state-of-the-art survey, perhaps with some updating, should constitute that best source, but any available alternative or additional information should be used. Hopefully, much of the process of reorganizing and regrouping this information on research can be done by computer. This, of course, will depend on the extent to which computer-usable files have been developed by the study project in its day-to-day operations.

F. Select Problems Requiring Research and Distinguish Responsibility

The next step in the Second Phase will be for the study project to carefully consider each specific problem in the light of on-going research. Some of this may have been accomplished incidental to the screening of research to find specific problems, a process discussed in D.1. above. In general, each problem identified must be treated as if it were a query to be used to search the file of research project for items that might affect it, whether they were categorized in the same problem area or not. Then the project personnel must decide what specific parts, aspects or implications of the research might affect the specific problem being considered. Problems that are deemed by the study project to be amply covered by existing or recent research should be removed from the list of problems which will be candidates for recommendations for research attention. Written records should be kept of the problems so removed, and the reasons for their removal.

Items remaining must be considered one by one with relation to the need of the Army, the DOD, other Federal organizations, and the field in general, as apprehended by the project on the basis of its work to that date, and also in their relation to each other, e.g. network research. They must particularly be considered in relation to the missions, objectives, management practices, etc., discussed in III.B. They should first be divided into three groups (or as requested by the sponsoring authority at that time). These are:

1. Problems of sufficiently direct concern to DOD, or some department thereof, to warrant full sponsorship of required research by DOD.
2. Problems of sufficient concern to DOD, or some department thereof, to warrant participation by the DOD in multiple sponsorship of required research.
3. Problems of interest to other Federal agencies outside DOD and not appropriate for DOD sponsorship.

It is conceived that an acceptable variation of the delegated or responsible agency concept, as developed by the Weinberg Report and the SDC Recommendations for Document Handling Systems in Science and Technology, might be considered by the study project in the Second Phase "for distinguishing between those which should have multiple sponsorship and those which should be sponsored outside DOD." The study project should be prepared to develop a system for continuing exchange of information among DOD and other Federal agencies on both current and planned research projects, and also to describe procedures for using a central mechanism such as the Federal Library Committee and/or COSATI to regularly review research requirements and distinguish, with consent, among the responsibilities of DOD and other Federal agencies.

As a final step of the Second Phase the problems listed in 1. and 2. above should each be assigned some priority. The following priorities would seem appropriate at this point in time, but the study project should have a better list to offer by the time it reaches this stage: --

Priority	Description
1	Urgently required for present mission
2	Significant contribution to present missions, effectiveness or efficiency expected
3	High priority for anticipated future missions
4	High potential for development of better library and information service operations in general
5	Significant potential for development of better library and information service operations in general.

IV. THIRD PHASE: DEVELOPMENT OF RESEARCH DESIGNS

A. Introduction 79

B. Gather Feedback From Second Phase Report 80
  1. Dissemination 80
  2. Collection 81

C. Evaluation of Feedback and Modification of Second Phase Recommendations 84

D. Development of Individual Research Designs 85
  1. Independent Variables Associated with the Research Designs 85
  2. First Round Development of the Research Designs 85

E. Determination of Budgetary and Other Constraints 89

F. Normalize and Re-distribute Emphasis as Necessary 90

G. Modification of Research Designs 91

IV. THIRD PHASE: DEVELOPMENT OF RESEARCH DESIGNS

A. Introduction

The objective of the third and final phase of the study project with whose design this report is concerned is to build on the efforts of the two preceding phases to produce, as the final product of the entire project, "a series of research designs for each project recommended". A number of specific items to be included in these research designs are specified by the contracting instrument and will be discussed separately later in this section.

There is no reason to feel that the specific items to be included in the research designs will need to be changed radically by the time the study project reaches the Third Phase, since they will still probably include the essential elements that any sponsoring or funding agency would need to prepare Requests for Proposals and evaluate responses received, or to develop an adequately detailed in-house research program. It does need to be remarked, however, that the steps the study project must take to get from the output of the Second Phase to this final product of the project may very well turn out to be quite different from anything that can be reliably foreseen at this time. In particular, it can be expected that the study project personnel may be able to find ways of anticipating some of the steps while still primarily concerned with the tasks of the earlier phases.

The most obvious opportunity for the study project to get an early start on the work of the third phase would seem to be in connection with the evaluation of the product of the second phase and in the amount of detail in which the project identifications are stated in the final report of the second phase.

B. Gather Feedback From Second Phase Report

While the procedure recommended in III.D.2. called for the study project to seek opinions and recommendations as to problem identification, whatever was recommended in the final report of the second phase would be strictly the project's own responsibility. In general, no one source of advice sought would necessarily become aware of the recommendations offered by some other source of advice. The responsibility for the final report of the third phase must also be the full responsibility of the study project. The responsibility of the Army or any other Federal agency that was participating would come in the determination of the extent and nature of the research designs recommended by the final report. However, it seems clear that the study project can best serve the purpose for which it was created by introducing at this point some serious and systematic input from the individuals and agencies which would eventually assume that implementation responsibility. Therefore, the first concern of the study project in initiating the third phase should be to insure an appropriately wide dissemination of the second phase report and then obtain reactions, comments and suggestions from competent and concerned sources.

1. Dissemination

It goes without saying that the second phase report would be submitted to a vigorous review procedure by the contracting authority including review and assessment by members of the Advisory Committee. It is also encumbent on the study project to send copies to all persons and organizations that participated in, or contributed to, the development of the report. Beyond that, however, the report should be distributed to other experts in the field and to at least those who are conducting or who might be known to be considering, research projects relative to Federal library or information service operations. This might have a further beneficial result of involving, at an early stage, people who would ultimately be directly or indirectly affected by the project's final recommendations.

2. Collection

A variety of methods for gathering feedback should be considered. Among the more popular are interviews (both personal and phone), questionnaires, representative advisory committees, and conferences. An examination of the relative advantages and disadvantages of each method, in the present context, suggests that no single approach would be completely adequate.

a. Working Conference Under proper circumstances, one effective and efficient approach would be to hold a working conference. Consideration should be given to asking the Military Librarians Division of the Special Libraries Association to sponsor such a conference in conjunction with their annual "Workshop". The Conference could then be supplemented with feedback derived by other methods (e.g. the study project Advisory Committee, interviews, etc.)

As presently conceived, such a conference might serve a variety of functions:

(1) It could provide a forum for open discussion of the Second Phase recommendations.

(2) It could assist in the identification and definition of additional problem areas and specific research problems.

(3) It could help the project to devise an acceptable reporting system regarding future research activities. This could be very important for any continuation effort. (See Section V.)

Before deciding that a conference should serve as a primary method of gathering feedback, consideration should be given to the advantages and disadvantages of a working conference and to factors affecting the usefulness of such a conference. Among influential factors that would need to be carefully planned and controlled to assure reasonable prospects of success and usefulness for such a conference are:

(1) The number and kinds of individuals in attendance It is generally conceded that the number and kinds of individuals in attendance, at a working conference, strongly influences whether the conference develops into a cohesive, productive work unit. If the number is large, it is often necessary to break up the conference into a variety of specialized study groups. This fragmentation would make it difficult to expose attendees to the complete conference. Similarly, a fair proportion of attendees should be principal librarians and managers of information services of the Army and other DOD and Federal agencies in order to assure responsible discussion.

(2) The dispersion of the potential attendees A population of widely dispersed attendees weighs heavily against the development of a working conference, which could be representative of the total population of Army, DOD and other Federal library and information services.

(3) The homogeneity of the conference subject matter and the body of attendees Working conferences are usually more effective and efficient where the subject matter under consideration as well as the attendees are of a homogeneous nature, thus alleviating the necessity of identifying a common ground for discussion.

Examining these factors, in the light of the conditions which seem likely to exist at the time of the proposed working conference, seems to indicate serious deficiencies in such a method of gathering feedback. That is, it appears likely that the number of attendees would exceed the level which would permit the development of a productive working conference, without fragmenting the conference into a number of smaller study groups; the attendees would probably be derived from a widely dispersed population; and the subject matter under discussion (i.e. research activities in Federal library and information service operations), and the body of attendees would be relatively heterogeneous. On the other hand, precautions could be taken to minimize the adverse effect of these factors on the conference (e.g. careful and detailed planning of the conference agenda, dividing up the conference into study groups, etc.).

There are insufficient grounds for a decision to be made regarding a working conference at this time. The obvious advantages seem to indicate that it should be considered, even if its structure would have to be modified to accomodate existing conditions. It should be the responsibility of the study project to make a recommendation to the contracting authority as to the desirability of proposing such a conference, after the project team has had a sufficient opportunity to examine and evaluate the conditions and needs for feedback on the second phase in consultation with the contracting authority and the Advisory Committee.

If a decision is made to hold such a conference, the study project should develop a complete study, covering the proposed agenda, specific procedures of conduct and a clear and concise statement of anticipated results to be derived.

b, Alternatives In addition to, or as one possible alternative to a working conference, the study project should discuss with the contracting authority the possible role of the Advisory Committee, created during the Second Phase of the study project, as a major source for review of recommendations in the Second Phase report. In conjunction with the feedback derived from the Committee, appropriate agencies (i.e. those affected by the recommendations of the second phase), should be surveyed by questionnaire. When necessary, these methods could be supplemented, in a statistically valid manner, by telephone and personal interview.

C. Evaluation of Feedback and Modification of Second Phase Recommendations

It is anticipated that an analysis and evaluation of the feedback will necessitate the modification of certain aspects of the recommendations of the Second Phase. As stated in III.F. the final report of the Second Phase will consist of three basic components:

1. the identification of problems relating to Federal library and information service operations,
2. a statement of recommended cognizance (i.e. those which should be the peculiar province of DOD, those whose sponsorship DOD should share, and those requiring sponsorship outside of DOD),
3. the recommended priority of each project.

Rather than considering these recommendations static, the study project must remain ready to make any changes which will reflect new information on actual needs and conditions. A change in a recommendation for a project could have implications for the project's recommended priority or cognizance. For instance, during the second phase, a project might have been recommended as being the peculiar province of DOD, with a particular priority. Feedback, derived from affected DOD organizations,could result in DOD advice that, because of the project's inter-agency implications, it should receive multiple sponsorship. It will then be the responsibility of the study project to re-examine the project to determine how it should be modified, and having done that, to make the appropriate recommendations. It is decisions of this type, that the analysis and evaluation of feedback will help the study project to make.

D. Development of Individual Research Designs

1. Independent Variables Associated with the Research Designs

Needless to say, the development of the research designs cannot take place in a vacuum. Almost all aspects of the individual designs will be substantially influenced by a number of "associated independent variables" which, at the present time, are somewhat difficult to anticipate. It will be necessary for the study project to isolate these variables, during the third phase, and at an appropriate time, consider their possible influence on the designs themselves.

Some of the more important variables to be considered are:

a. The complexity of the research problem being investigated. It is expected that the specificity of the design, in many cases, will vary inversely with the complexity of the research project,

b. The identities of the appropriate research and supporting staff,

c. The relative importance of the research project to the mission, effectiveness, and efficiency of the affected agencies,

d. The relevant state-of-the-art at the time the designs are formulated, and

e. Other research projects in progress, both internal and external to the affected agencies.

2. First Round Development of the Research Designs

The study project should develop the initial research designs on the assumption that all of the variables discussed above, and others not cited, exist in a reasonably "ideal" state (e.g. resources necessary to the accomplishment of the project's objectives are available, etc.). To attempt, during the initial design phase, to adapt the designs to accomodate all the real difficulties which might exist would constrain the creative development of the research designs by the study project.[18] Modifications to make the designs conform to existing real conditions will be discussed later.

Each of the research designs which were recommended as being the peculiar province of DOD, or which were recommended for multiple sponsorship (i.e. shared by DOD) will consist of eight basic elements: the statement of the problem, the objectives of the project, the methodology to be employed, the scope of the investigation, the nature of the research, the research staff required, the time schedule and the estimated cost of the project. Projects which were recommended for sponsorship outside of DOD possibly would be treated in less detail, that is, in general the design would state the objective of the project, its nature and its scope. The eight elements are discussed below:

a. Statement of Problem Each research design should be introduced by a clear statement of the problem it is intended to resolve. This would at least consist of a repetition of the problem statement developed as a result of the Second Phase effort. It should go beyond that, however, on the assumption that each research design can be expected to be taken out of the context of the entire study project effort and its reports. Thus it would be helpful to an implementing agency to have some idea of why this particular problem was identified by the study project. Additional information, such as statements of the various problem areas this particular problem is thought to relate to would also be of assistance. Factors or tendencies known to either mitigate or complicate the problem should be mentioned. These should include, but not be limited, such environmental factors as departmental policies and resource availability.

b. Objectives The statement of objectives should specify in terms of the preceding problem statement just what aspects of the problem the particular research effort is expected to work on. Normally a single primary objective can be stated. Though this will be at least as specific as the problem statement, it may still be fairly broad. If so, it must usually be broken down into a hierarchy of lesser objectives.[13] If any specific product is desired, it must be specified somewhere in the statement of objectives. In general, the objectives must specify what the particular research project is to do or produce without constraining the subsequent implementation effort by specifying how to do it.

c. The Methodology To Be Employed The study project should indicate by means of a statement of the methodology to be employed its views on how to go about accomplishing the stated objectives. Generally, the methodology will be stated in terms of an overall outline of the research effort. Major phases should be identified and tasks which the study project feels to be important to the accomplishment of the objectives should be identified within the phases. The study project should propose the level of detail to include and also state how strictly it feels its recommendations should be followed.

In general, the statement of methodology should indicate where theoretical means should be used, where experimental, and where a statistical approach might be expected to be most effective. It might, for example, recommend that a survey be conducted by means of a questionnaire. It might further indicate certain feelings as to sample size, stratification, etc. Only under unusual circumstances would it be desirable to specify how a random sample was to be generated or how the stratification was to be accomplished.

d. The Scope of the Investigation In most cases it will be necessary for the study project to indicate the extent, or coverage, of the specific project being detailed. Such scope specifications must be made for every important parameter the study project can identify. Examples of scope specifications would be answers to such questions as the following: What sizes or kinds of organizations should be considered? What numerical limits should be observed with respect to costs, sizes, weights, space comsumption, etc.? What range of hardware, software, etc., should be included in the project's investigations?

e. The Nature of the Research Project The study project should also state the probable best nature of the research project being recommended in administrative, managerial, and organizational terms. This may include recommendations as to the most appropriate kind of an organization to do the job (e.g. operating Federal information service, Federal research laboratory, university sponsored research center, industrial research organizations, etc.) but a specific organization would not be named. Other matters which the study project would consider include centralization vs. decentralization, levels of professional competence required for specific tasks and whether a one-time effort or a continuing effort would seem to be needed.

f. Research Staff Required The study project should also make recommendations as to the size and composition of the research staff required. This should be stated as an estimate of the numbers, types, and qualifications of persons desirable for successful conduct of the research.

g. Time Schedule The study project should also recommend what it feels to be a reasonable time schedule. Where there are time-manpower tradeoffs, a choice will already have been implied in the preceding staff estimates. There will be many cases in which a factor other than manpower level will determine time schedules. A simple diagram (Gantt chart) may suffice in some cases. In others, more elaborate means, perhaps supplemented by some discussion, will be needed. In such cases the study project should consider employing PERT-Time as a method of planning, estimating and scheduling the project.

h. The Estimated Cost The study project must make the best cost estimates it can based on the foregoing and other known environmental factors. Such estimates will be important both to help an implementing agency to decide how best to apply its resources or organize its research effort and also to estimate an overall dollar cost by total program, by Federal agency, and perhaps by other parameters. Such totals, imprecise though they may be, provide the best means of gauging how well the recommended program matches the available resources. Where mismatches are large, the study project's recommendations will be of little practical use to interested Federal agencies. They must then be revised or "normalized" to bring the recommended totals more nearly into line with available resources. This will be further discussed below. The governing elements of cost are usually salaries together with their associated overheads and the time required for completion. However, in sepcific cases, other items may loom large in the cost picture. These include travel, consultant services, computer costs or rentals, telephone or other communications, and supplies, postage and other miscellaneous expenses. The study project should consider using PERT-Cost in such complicated cases.

E. Determination of Budgetary and Other Constraints

After all of the research designs have been completed the costs that were estimated under "ideal" conditions should be totaled. This may be done over the total number of projects costed, over subsets of these, or both. In any case it is more likely than not that the respective totals will exceed the amounts of money that can be realistically expected to be available.

Similarly, though it will probably not be possible to work as quantitatively as with cost estimates, other real-world limitations and constraints have to be taken into account. Much of this will have been done either intentionally or unintentionally already. At this point a conscious objective effort should be made to reconsider the entire questions of constraints. Interactions with such real-world variables as missions and budgets may have to be looked at with different groupings in mind than the apparent ones considered in early stages. In particular, every reasonable effort should be made by the study project staff at this time to consider its recommendations in broad perspectives in relation to the various organizations, groups of organizations, programs, disciplines, etc., which could be affected.

F. Normalize and Re-distribute Emphasis as Necessary

On the basis of the constraints determined as above, an attempt should be made, in collaboration with the contracting authority and perhaps the Advisory Committee, to "normalize" at least the overall costs called for by the recommended research program. By this is meant adjusting the total to fit, at least roughly, say with a 20% tolerance, the respective totals of funds estimated to be available. Similarly, if any other of the "real-world limitations and constraints" as looked at above so require, further adjustments may need to be made in determining priorities among those issues requiring attention.

While such adjustments--with particular reference to those relating to cost, since they are the easiest to conceptualize--could be made by a simple across-the-board cut (increases being assumed quite improbable) it is most unlikely that that would be a reasonable way to proceed. It must be supposed that the adjustment process will, in addition to meeting overall limitations, require re-distributions of emphasis among the projects recommended and detailed. These adjustments should be made by the study project in close coordination with the contracting authority.

G. Modification of Research Designs

To complete the work of the study project, the research designs previously developed must be revised as necessary to reflect the normalization and re-emphasis processes just discussed. In the course of doing this the project must re-examine the entire design. A cut in the designed cost, for instance, will have to be accounted for by a reduction in estimated staff, computer time, or some other aspects of the design. These in turn may have secondary effects that must be watched for and taken account of.

V. CONTINUATION ACTIVITY

A. Introduction

If the long range research program which has been designed in the preceding sections is worth doing--and it certainly is--then it is even more worth continuing to keep up to date the main products that will have resulted from it. This is necessitated by the continuous day-to-day progress made in the sciences and the technologies that affect--or may in the future affect--the world of library and information services. It is made even more necessary by the changes in our human institutions, in our general behavior patterns, our level of sophistication, especially with reference to the use of information, and in organizational structures, missions, etc.

B. Maintenance of a Directory of Research In Progress

In the process of carrying out its assigned tasks, the study project will, at the end of the first phase, have developed a comprehensive body of information about on-going research relevant--or potentially relevant--to Federal library and information service operations and to research in the information sciences generally. Information on current and completed research should be continuously up-dated and made available to all Federal agencies and to public and private information organizations throughout the country. The body of information should of course be put into computer-usable form and made accessible to remote inquiry via telecommunication channels of one of more varieties in general use at the time.

In addition to maintaining the body of information current in computer-usable form, an up-dated report, generally similar in nature and content to the First Phase Report should be issued from time to time, say at six month intervals. The up-dating process by which the report would be produced should consist of more than simply adding or deleting the research project descriptions. It should also include revision of the analytical discussions of various aspects of the field in order to highlight the importance of new research, note the completion of related groups of research, etc.

C. Continuation of Problem Identification Effort

The identification of problems on which research appears to be needed should also be kept current. Changes in this list will be caused by changes in the Directory, and in the state-of-the-art, as just noted. There will, however, be an essential additional input to cause the list of "identified problems" to be changed. That is the appearance of new needs and the disappearance of old ones. In general, the same kind of approach to the identification of problems on a continuing basis as was recommended for use in the Second Phase of the study project, should be effective.

D. Continuation of Research Design Development Effort

It would seem at this time that it would also be useful to continue to develop detailed research designs for new problems identified in essentially the same manner as was recommended for the third phase of the study project. Any such effort should be strictly utilitarian, however, and should not be allowed to continue merely for the sake of completeness. Such an effort would not, for example, attempt to keep track of the actual research designs in use, or planned. If anything of this nature was needed ti should be incorporated into the Directory discussed in B. above.

E. Revision of the Long-Range Research Program Itself

A particularly important function that needs to be provided for is the revision, on a continuing basis, of the methodology, techniques, and other aspects of the "long range research program" (i.e., the successor to the study project) itself. This function is primarily the responsibility of the Federal agencies that have to maintain up-to-date, effective and efficient library and information services. It should also be the responsibility of the study project itself, if continued, to make recommendations to the appropriate agency or committee coordinating Federally sponsored research in technical information areas.

F. Reporting the Continuation Activity

The continuation effort should be structured and administered along generally the same lines as the original study. The study team should report to the appropriate agency or coordinating authority at some reasonably frequent intervals, presenting an up-to-date view of developments relevant to the missions of DOD and other agencies in this area. These briefings, or reports as the case may be, should be generally similar to those of the original study.

G. Statistical Reporting

The continuing reporting system should provide for both substantive and statistical reporting on a progressive basis. Statistical reporting should provide a current and retrospective record useful in evaluative and comparative analysis. Statistics should be gathered regularly, at no less than annual intervals, on operations characteristics, resources, and costs. Both management and user data should be gathered on these and other elements which can be represented quantitatively. The exact determination of what statistics can and should be collected, and at what intervals, will need to be determined in close consultation with the contracting authority and with cooperating agencies. In some cases, as for example statistics on space, collection of data would need to be undertaken only every four or five years. The total research design would need to take this into account.

VI. IMPLEMENTATION

Included in this section are considerations which should guide the Army, other DOD agencies, and in fact all Federal agencies concerned with implementing the three study phases leading to development of the long range research program. It is recognized that many decisions as to implementation must be made by sponsoring agencies on the basis of facts and policies peculiar to their particular departments. Nevertheless, it seems desirable to review some of the principal elements involved in preparing this design study that relate to the administrative and practical aspects of implementation in hopes they might be of some assistance.

The research program as presently planned in the foregoing three phases will concentrate on the technical information problems of the Army, but will also consider them in relation to the needs of all Federal technical information programs. Because of the large degree of commonality among DOD and other Federal agency library and information problems and programs, it would be wasteful for TISAP to make such a study without including the total Federal environment.

A. Time Estimate

Figure 2. gives the estimated time schedule for the three phases of the long range research project, not considering any continuation activity. The principal requirements for time in the first and third phases are to insure thorough interaction with the many individuals and organizations that need to be contacted. In the second phase the need to do in-depth studies of such a broad range of substantive areas as well as to interact adequately with those concerned with missions, networks, internal objectives and management policies.

TIME SCHEDULE FOR LONG RANGE RESEARCH PROGRAM

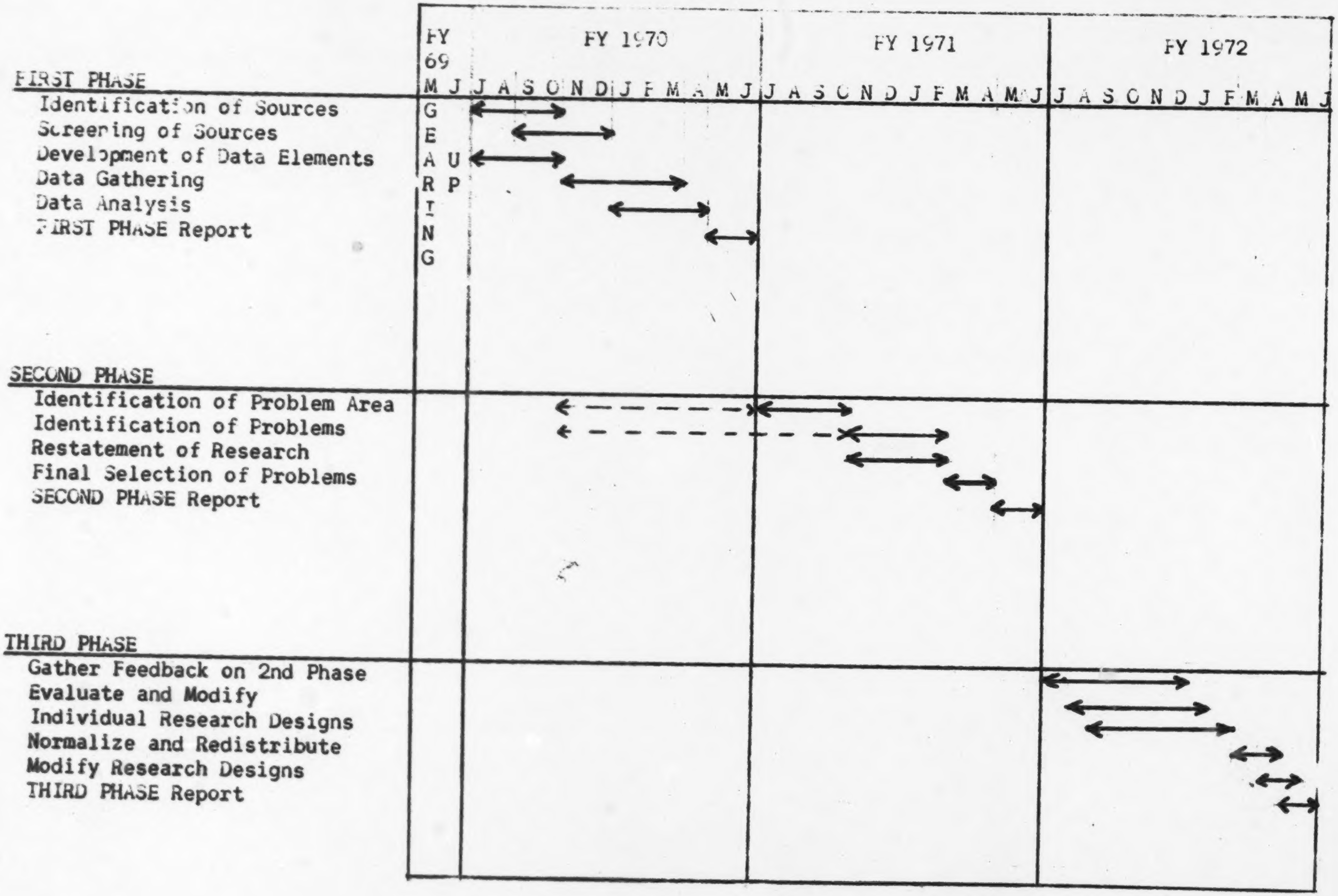

Fig. 2

B. Cost Estimates

Cost estimates will depend on many factors which will vary with the nature of the organization performing the long range research program. Such factors include overheads, amount and charges for in-house administrative support available to such a program and computer charges. A rough estimate can be based on assuming 2 1/2 technical staff for the first phase and three for the second and third phases. Applying general rule-of-thumb factors to these assumptions would suggest the following ranges in thousands of dollars:

First Phase:	75 - 90
Second Phase:	90 - 110
Third Phase:	90 - 110

C. Sponsorship and Size of Project

In developing the approach and methodology for the long range research program, this design study has followed the same modus operandi that it recommends for the third phase of the study project. That is, it has first designed on the basis of what appears both reasonable and desirable without on the one hand going all out to attain perfect state operation or on the other hand allowing itself to be overly parsimonious with resources simply because there was no assurance that the resources being called for would be available.

For purposes of practical implementation, it must be assumed that there is some sort of an optimal size of effort for the long range research project, one that will secure maximum effectiveness consistent with prudent expenditure. In general, the concept has been to arrive at an optimal mode which combines maximum potential with minimized expenditure of available resources. The timing and resource schedule for that effort shown in Figure 2. and the cost estimates given in Section B. are based thereon. Thile the design study team knows of no way to substantiate this "optimal size", especially by any quantitative means, the discussion in the next two sub-paragraphs of the effects of increased or decreased resources for the study project should help to explain the reason for feeling that it exists.

1. Reduced Resources

The principal effect of reduction of resources below an optimal level would be to reduce both the scope and reliability of the study project's coverage. This effect would take different forms in each of the three phases, but in each of them would operate primarily through one of the four following mechanisms: (1) Reduction in number of staff required, (2) Reduction in professional level of staff involved, (3) Reduction in use of computer capabilities and (4) Reduction in use of travel, hence first hand experience. The result in the first phase probably would be some combination of reduction of number of efforts surveyed with increased dependence on information and data gathered by others. In the second phase, the principal effect would be some curtailment of the study and survey activities on which the hope of increasing objectivity is based, hence a resulting increased dependence on subjective judgment. The principal effects in the third phase would be reduced opportunity to gather and evaluate feedback and reduced opportunity to base the research designs on the careful studies they should be based on.

2. Increased Resources

Not too surprisingly, the result of being able to apply more resources to the project than those envisioned would, in general, be the converse of those mentioned above with respect to decreased resources. This is certainly so with respect to the mechanisms through which such increased resources would operate: increased number and quality of staff, increased utilization of computer facilities and increased travel.

The principal effects in the first phase would be that more potentially related research could be looked at, and that the study project could probe further into the "fine structure", to borrow a term from physics, of the projects surveyed. In the second phase more competence in terms of various related disciplines and technologies could be included both on the project staff and in the advisors contacted. The result would be to heighten objectivity by both extension and intension of the ensuing study of relevant library and information service problem areas and specific problems. Finally, in the third phase, more opinions could be gathered and appropriately used, and greater attention could be paid to the scientific and technological elements involved in the specific research designs being developed. A really significant increase in the resources available for the third phase would enable the conduct of several feasibility studies--probably in some cases by subcontract--to better validate some of the more important research designs.

3. Specific Recommendations

As a consequence of the above considerations, it would seem fairly certain that the objectives of the Chief of Engineers would be greatly enhanced if the study project could be supported at or above the recommended level of effort indicated in B. above. To attain this level of funding support would very likely require the participation of additional Federal agencies. Clearly such participation would be especially advantageous for reasons over and above financial ones. The solution to problems common to more than one Federal agency would be attacked through coordinated or cooperative research programs in which awareness of information research efforts would be maximized. To be quite practical, the additional influence accruing to the project by virtue of a broader sponsorship base should also produce tangible and significant benefits in terms of cooperation and access to information on the part of the non-participating agencies.

More specifically, cooperative sponsorship by agencies within the Office of the Secretary of Defense, such as RDT&E, ARPA, etc., by the Office of Education and by the National Science Foundation would each bring particular advantages. Participation by the other Departments of the DOD (Navy and Air Force) would also be particularly beneficial. Endorsement and coordination by the Federal Library Committee, COSATI, or any embryonic form of the National Commission on Library and Information Science would be tremendously valuable. It is recommended, therefore, that the Federal Library Committee assume the responsibility for obtaining, to an appropriate extent, multiple sponsorship and support for the three phased program proposed in this design study. However, the dispension of funding among Federal agencies should be kept to a minimum so that the multiplicity of funding sources would not impede the progress of the study project nor complicate contract monitoring and communication flow.

D. Single Versus Multiple-Contractor Implementation

The detailed prescriptions for the three phases might, at first glance, appear to be so different as to invite implementation by two or three contractors. The design study team, however, recommends for reasons detailed below that implementation be undertaken by a single contractor. Both the identify and the quality of the research designs resulting from the long range research program will depend strongly and intimately on the work done in, and the products of, the preceding two phases. The difficulties of communication, and the transfer value inherent in the progressive development of the program, make it almost mandatory that there be as much continuity as possible throughout the three phases. All three phases require the development of an unusually comprehensive point of view and feeling for the entire field of library and information services, and the development of. a sense of perspective in relating each part of the broad picture to whatever other part it might interact with. Thus the more the study project can keep the same persons involved, with accumulating know-how and expertise, the better will be its final product.

Another distinct advantage is important. That is, as mentioned several times in the preceding sections, there will be many opportunities to accomplish several purposes with a single effort. For example, a visit to an installation conducting current research in areas related to library or information service operations could confidently be expected to produce inputs for the second phase and even some material in anticipation of the third phase, as well as the primary objective of securing material on the research in progress.

REFERENCES CITED*

The conduct of this design study has, of course, required a detailed literature survey of library and information services research both within and outside the Federal Government. For those desiring a broad range of literature sources on the role of Federal library and information services, the bibliography in reference 24 below is recommended. For those desiring further references on the substantive areas discussed in Section III.C. and other places throughout the report, the bibliographies in references 3, 4, and 5 are recommended. Such comprehensive bibliographies are readily available to the interested reader and it was considered neither desirable nor feasible to construct a large bibliography for attachment to this study. In addition, reference 10 cites documents held by the Defense Documentation Center dealing with Technical Information Centers and Libraries.

1. American Institute of Physics Staff. "Techniques for Publication and Distribution of Information", In *Annual Review of Information Science and Technology*. Edited by Carlos A. Cuadra. Vol. 2, 1967, New York: Wiley. 1967. pp. 339-384.:: 69.
2. American Library Association. *The Library and Information Networks of the Future*. Prepared for Rome Air Development Center, Air Force Systems Command, United States Air Force. (RADC-TDR-62-614) Chicago: American Library Association. 1963. :: 48.
3. *Annual Review of Information Science and Technology*. Edited by Carlos A. Cuadra. Vol. 1, 1966, New York: Wiley. 1966. :: 42
4. *Annual Review of Information Science and Technology*. Edited by Carlos A. Cuadra. Vol. 2, 1967, New York: Wiley. 1967. :: 42
5. *Annual Review of Information Science and Technology*. Edited by Carlos A. Cuadra. Vol. 3, 1968, Chicago: Britannica. 1968. :: 42
6. Auerbach Corporation, *DOD User Needs Study, Phase I. Final Technical Report*. Philadelphia, Pennsylvania. 14 May 1965. 2 vols. AD615 501, and AD615 502. :: 7.

---

* Page numbers on which references are cited follow the double colon (::).

7. Bush, Vannevar. "As We May Think", Atlantic Monthly, Vol. 176, No. 1 (July, 1945), pp. 101-108. :: 48.

8. Bush, Vannevar, Endless Horizons, Introduction by Frank B. Jwett. American Council on Public Affairs, 1946. :: 7.

9. Clapp, Verner W. The Future of the Research Library. Urbana: University of Illinois Press, 1964. :: 72.

10. Defense Documentation Center. Technical Information Centers and Libraries: A Report Bibliography. Prepared for the Office, Chief of Engineers, U.S. Army. (Search Control No. 007716). January, 1969. :: 104.

11. Gaines, Ervin J. "The Large Municipal Library as a Network", Library Quarterly, Vol. 39., No. 1, (January, 1969). p. 50. :: 59.

12. Goldwyn, A.J., et al. "Analysis of Results", Part II of An Inquiry into Testing of Information Retrieval Systems. Final Report of the Comparative Systems Laboratory, Center for Documentation and Communication Research, School of Library Science, Case Western Reserve University, Cleveland, Ohio. 1968. CSL: TR-FINAL-11. p. 197. :: 47,73.

13. Granger, C.H. "The Hierarchy of Objectives", Harvard Business Review Vol. 42, No. 3 (May-June, 1964), pp. 63-74. :: 87.

14. Heilprin, L.B. "On the Information Problem Ahead", American Documentation Vol. 12, No. 1, (Jan., 1961), pp. 6-14. :: 52.

15. Human Sciences Research, Inc. Methodology for Test and Evaluation of Document Retrieval Systems: A Critical Review and Recommendations. By Monroe B. Snyder, et at. McLean, Va. 1966. PB169 572. :: 73.

16. Libbey, Miles A. and Gerald Zaltman. The Role and Distribution of Written Informal Communication in Theoretical High Energy Physics. American Institute of Physics, and U.S. Atomic Energy Commission. 25 Aug. 1967. AIP Report No. AIP/SDD-1 (Rev); USAEC Report No. NYO-3732-1 (Rev). :: 8, 62.

17. Massachusetts Institute of Technology. Annual Report on a Study of Information Requirements for Research and Development. Alfred P. Sloan School of Management, Massachusetts Institute of Technology Cambridge, Mass. Aug. 1968. PB 179 538. :: 7.

18. Nadler, Gerald. Work Systems Design: The IDEALS Concept. Homewood, Illinois: Irwin. 1967. :: 86

19. National Library of Medicine. Entry in "U.S. Government Procurements; Services", Commerce Business Daily, U.S. Department of Commerce, Thursday, March 6, 1969. :: 55.

20. North American Aviation. DOD User Needs Study, Phase II. Flow of Scientific and Technical Information Within the Defense Industry. 3 vols. Autonetics Division, Anaheim, Calif., Nov. 1966. AD647 111 - AD647 113. :: 7.

21. Orr, Richard H. et al. "Development of Methodologic Tools for Planning and Managing Library Services: I. Project Goals and Approach", Medical Library Association Bulletin, Vol. 56, No. 3, (July, 1968) pp. 235-240. :: 33.

22. Orr, Richard H. et al. "Development of Methodologic Tools for Planning and Managing Library Services: II. Measuring a Library's Capability for Providing Documents", Medical Library Association Bulletin, Vol. 56, No. 3, (July, 1968). pp. 241-267. :: 33.

23. Orr, Richard H. et al. "Development of Methodologic Tools for Planning and Managing Library Services: III. Standardized Inventories of Library Service", Medical Library Association Bulletin, Vol. 56, No. 4, (Oct. 1968). pp. 380-403. :: 33.

24. Painter, Ann F. The Role of the Library in Relation to Other Information Activities: A State-of-the-Art Review. TISA Project Report No. 23. Prepared for the Office of the Chief of Engineers, Department of the Army. Graduate Library School, Indiana University. Aug. 1968. :: 37.

25. Pratt, A.D. "Objectives and Performance Evaluation of Information Systems", In the Proceedings of the American Society for Information Science, vol. 5, 1968, New York: Greenwood. 1968. pp. 323-325. :: 43.

26. Proceedings of the Forum of Federally Supported Information Analysis Centers. 7-8 November 1967. Federal Council for Science and Technology, Washington, D.C. Committee on Scientific and Technical Information. 1968. PB177 051. :: 26, 73.

27. Sage, C.R. et al. "Adaptive Information Dissemination", American Documentation, Vol. 16, No. 3, (July, 1965). pp. 185-200. :: 61.

28. Sharpe, John R. Some Fundamentals of Information Retrieval. New York: Maxwell. 1965. p. 121. :: 48

29. Tompkins, Mary L. "Summary of Symposia on Mechanized Information Services in the University Library", Part 2 of the Final Report on Mechanized Information Services in the University Library, Phase I--Planning. Institute of Library Research, University of California, Los Angeles, California. 15 Dec 1967. :: 64.

30. U.S. Federal Council for Science and Technology. Committee on Scientific and Technical Information. Directory of Federally Supported Information Analysis Centers. Washington, D.C. Federal Council for Science and Technology, 1968. PB177 150. :: 15, 22.

31. U.S. Federal Council for Science and Technology, Committee on Scientific and Technical Information. Recommendations for National Document Handling Systems in Science and Technology. Washington, D.C. Appendix A. A Background Study, Vol. I. November 1965. AD624 560. :: 73.

32. U.S. Office of Education. Survey of Special Libraries Serving the Federal Government. Washington, D.C.: U.S. Government Printing Office. (OE-15067). 1968. :: 15, 22.

33. Zinn, Karl L. "Instructional Uses of Interactive Computer Systems", Datamation, Vol. 14, No. 9, (September, 1968). pp. 22-27. :: 56.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*
Research Center for Library and Information Science
Graduate Library School
Indiana University, Bloomington, Indiana 47401

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3. REPORT TITLE
Design Study for Long Range Research Program

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
Final report

5. AUTHOR(S) *(Last name, first name, initial)*
Bernard M. Fry, Miles A. Libbey, Allan D. Pratt, Thomas J. Waldhart

6. REPORT DATE
10 April 1969

7a. TOTAL NO. OF PAGES
102

7b. NO. OF REFS
33

8a. CONTRACT OR GRANT NO. Purchase Order No. E.F. 69-33, Amend #1, 30 Jan. 69

b. PROJECT NO. TISA Project
Work Unit 01/003

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)

9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*

10. AVAILABILITY/LIMITATION NOTICES
Distribution of this document is unlimited

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
U.S. Army
Office of Chief of Engineers

13. ABSTRACT

A plan is presented for a three-phase long range research program the objective of which will be to identify technical information problems and policies relating to Federal libraries and information services, to determine priorities among those issues requiring attention and to develop research designs for each project recommended. The first phase would consist of a state-of-the-art study to identify all current or recent research germane to the objective. The second would review all aspects of Federal library and information service operations to determine where problem areas might exist. Then specific problems and policies affecting the effectiveness and efficiency of Federal technical information support activities would be identified within such problem areas, priorities assigned to them and a determination made as to the extent of DOD (especially Department of the Army) and other agency interest in them. Finally, in the third phase, a fairly detailed research design would be developed for each project determined to be of some degree of interest to DOD or to sponsoring agencies outside DOD. It is recommended that after the completion of these three phases a continuing study effort at an appropriately reduced level of activity be maintained to assure currency and relevance of the long-range research program. A plan for implementation of the program is included.

DD FORM 1 JAN 64 **1473**

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Problem identification methodology						
Research program design						
Research summary						
Federal library and information service operations						
Libraries						
Information Centers						
Information Analysis Centers						
Information Services						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2*a*. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2*b*. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7*a*. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7*b*. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

8*a*. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8*b*, 8*c*, & 8*d*. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9*a*. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9*b*. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through
____________________________________."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through
____________________________________."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through
____________________________________."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS)*, *(S)*, *(C)*, or *(U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Idenfiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, rules, and weights is optional.